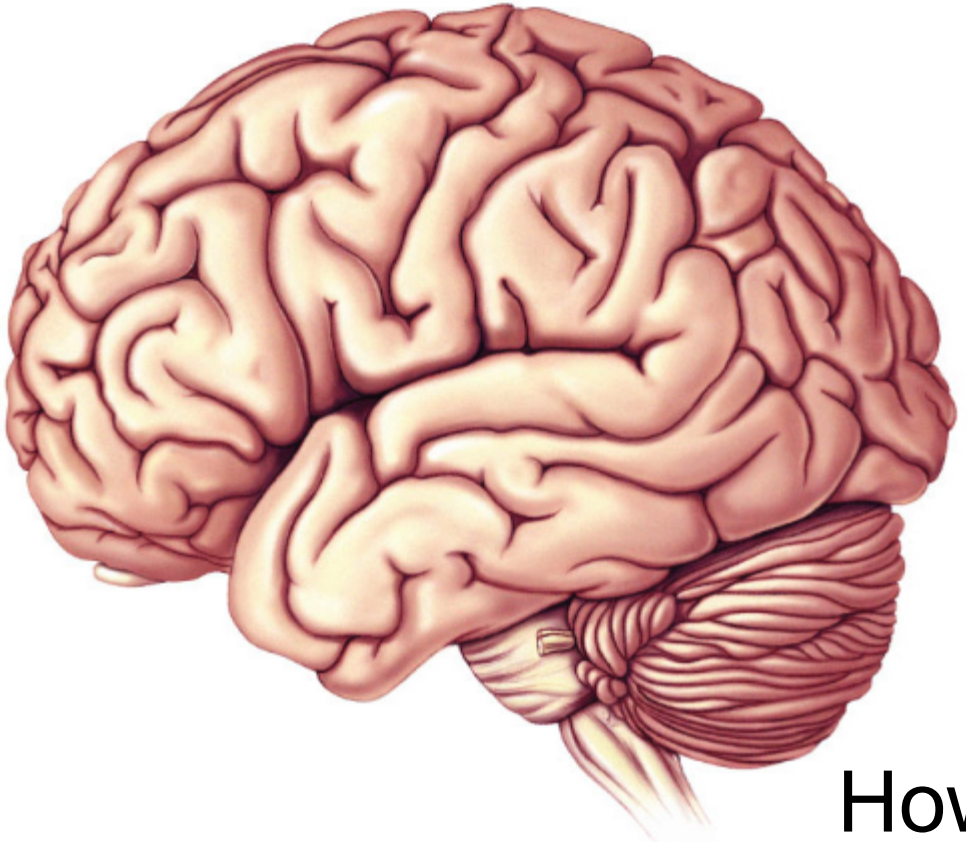


The Brain

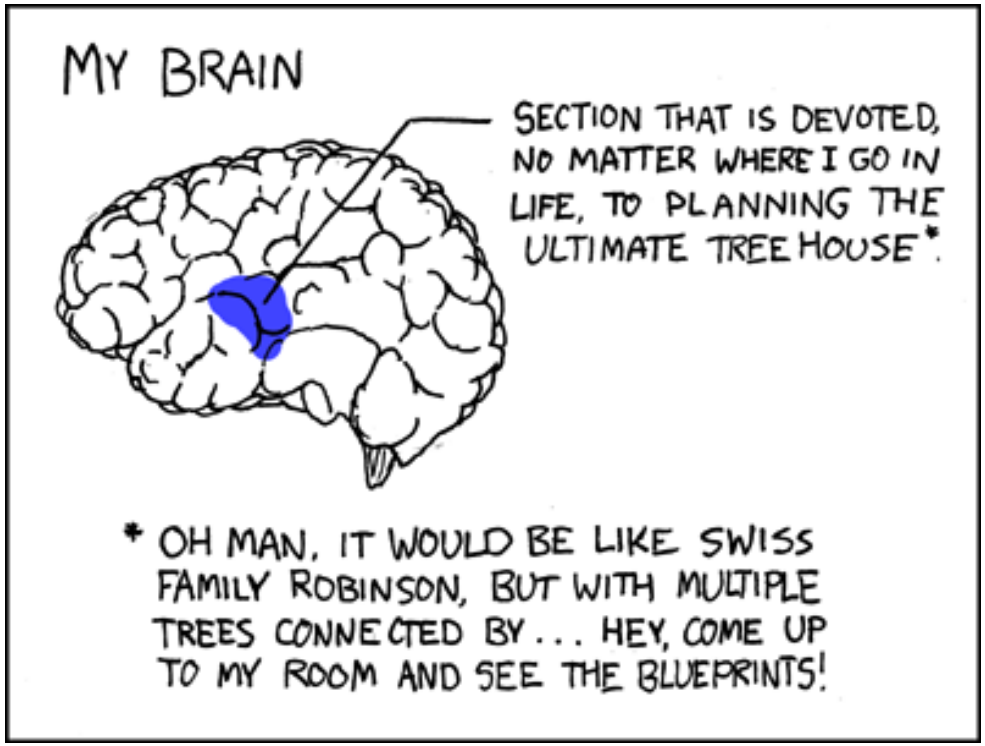
Its major systems,
How we study them,
How they make the mind

9.00 Introduction to Psychology
Joanne's Recitation Section
Friday, February 11, 2011

Outline

1. Syllabus:
   - Course Requirements, Exams, Grading
2. Introduce Yourself!!
   - Name, Class Year, Where You're From, Hobbies / Something Interesting about Yourself
3. The Brain --> Neuroanatomy
4. Methods of studying the human brain
5. Discussion

What are the major systems of the brain?



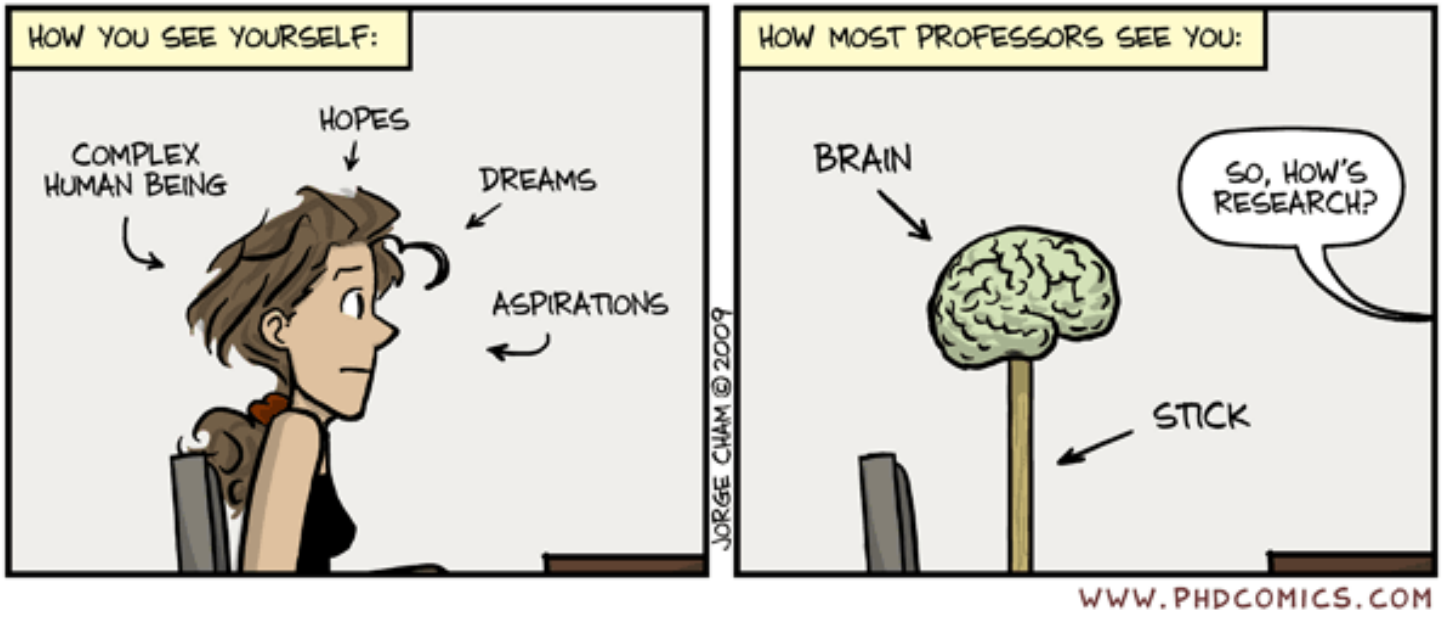
Randall Munroe, http://xkcd.com/212/

Matt Groening, The Simpsons

How do we study the brain?

Gary Larson, The Complete Far Side, Vol. I

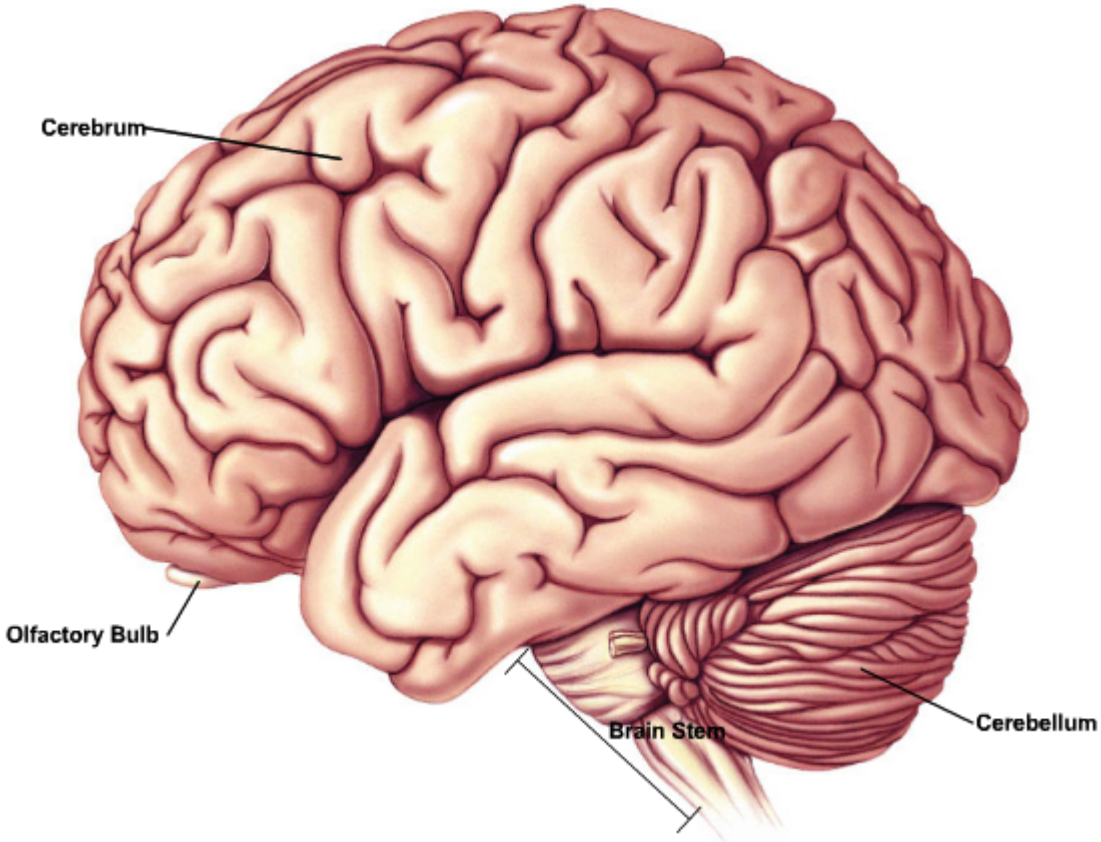
How does the brain make the mind?



Jorge Cham, http://www.phdcomics.com/comics/archive.php?comicid=1126

Neural Macroanatomy

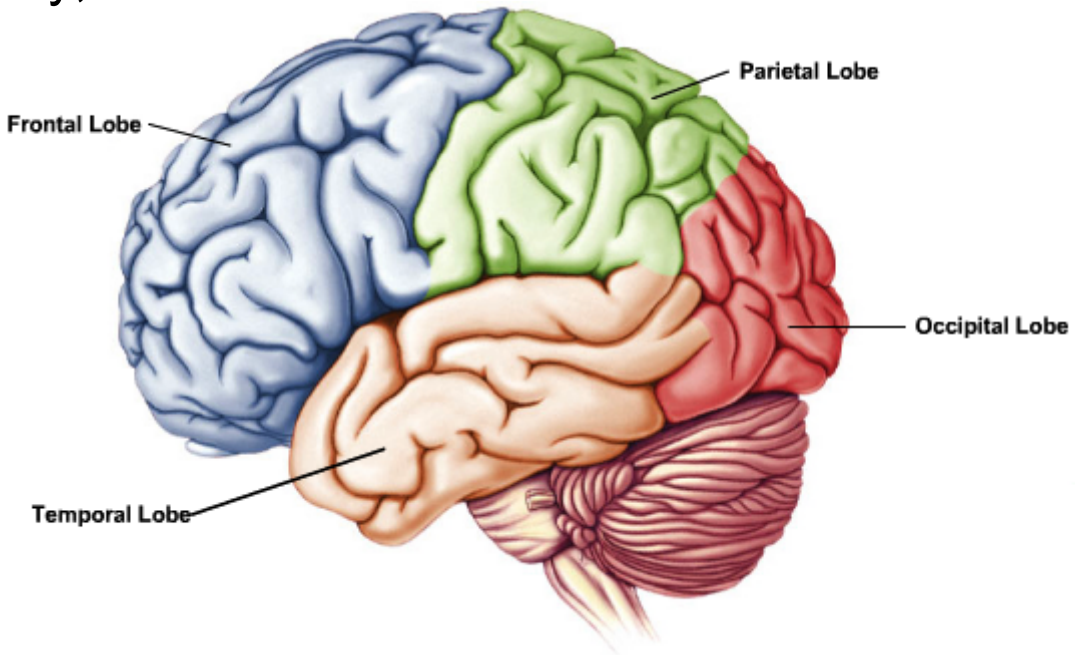
- Cerebrum
  - neocortex, basal ganglia
- Thalamus, hypothalamus
- Cerebellum
- Brain stem



Interactive Guide to Human Neuroanatomy; Bear Connors & Paradiso (2003)

Neural Macroanatomy

- Frontal Lobe:
  - cognition, attention, memory, decision making, motor planning
- Parietal Lobe:
  - memory, spatial-motor mapping, attention, touch
- Temporal Lobe:
  - hearing, memory, object recognition, semantic knowledge
- Occipital Lobe:
  - vision



Interactive Guide to Human Neuroanatomy; Bear Connors & Paradiso (2003)

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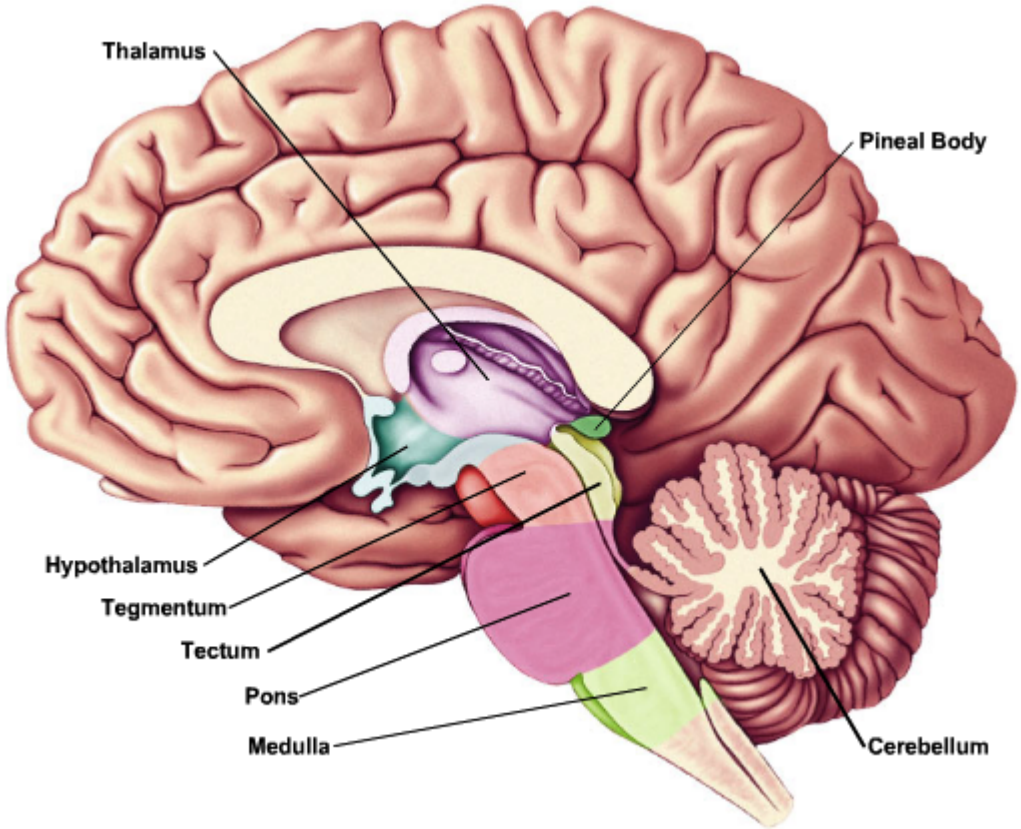

Interactive Guide to Human Neuroanatomy; Bear Connors & Paradiso (2003)

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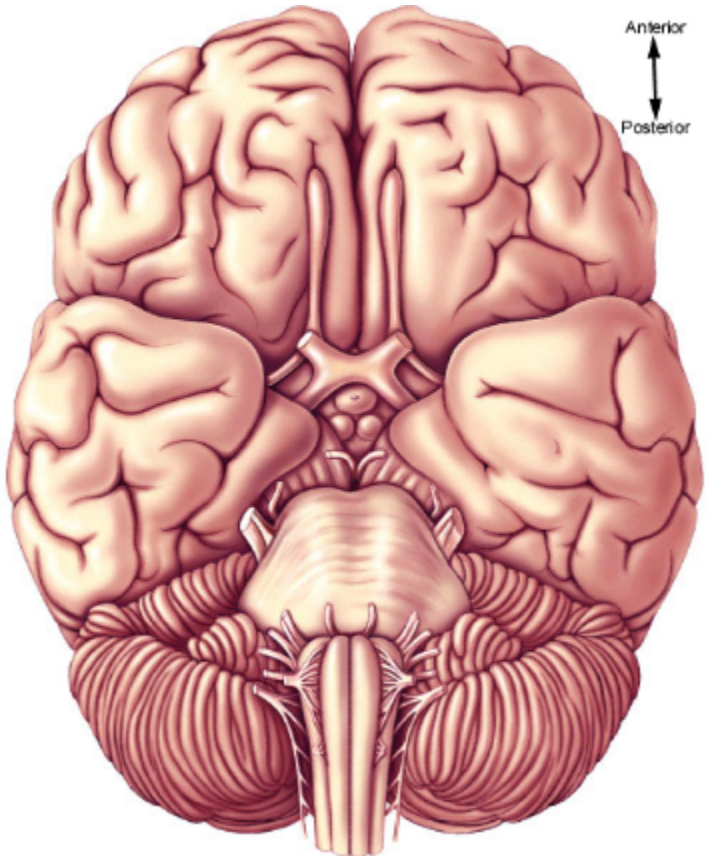
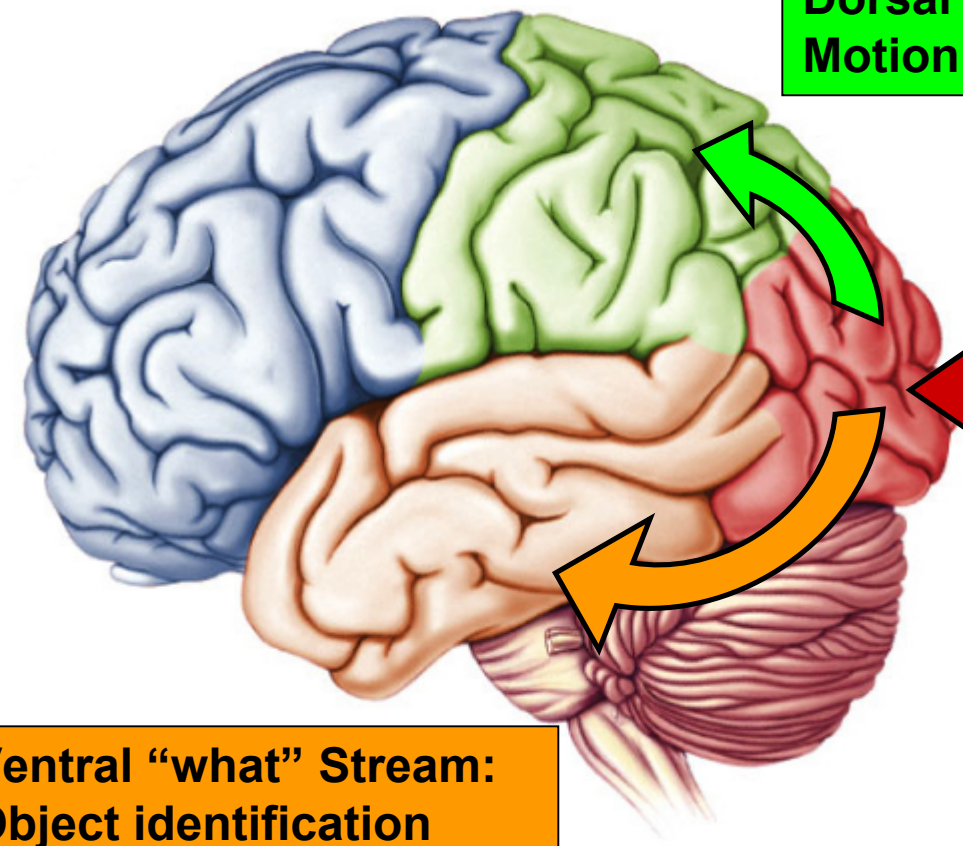


Interactive Guide to Human Neuroanatomy; Bear Connors & Paradiso (2003)

Sensory Systems: Vision

Dorsal "where" Stream:
Motion and spatial processing

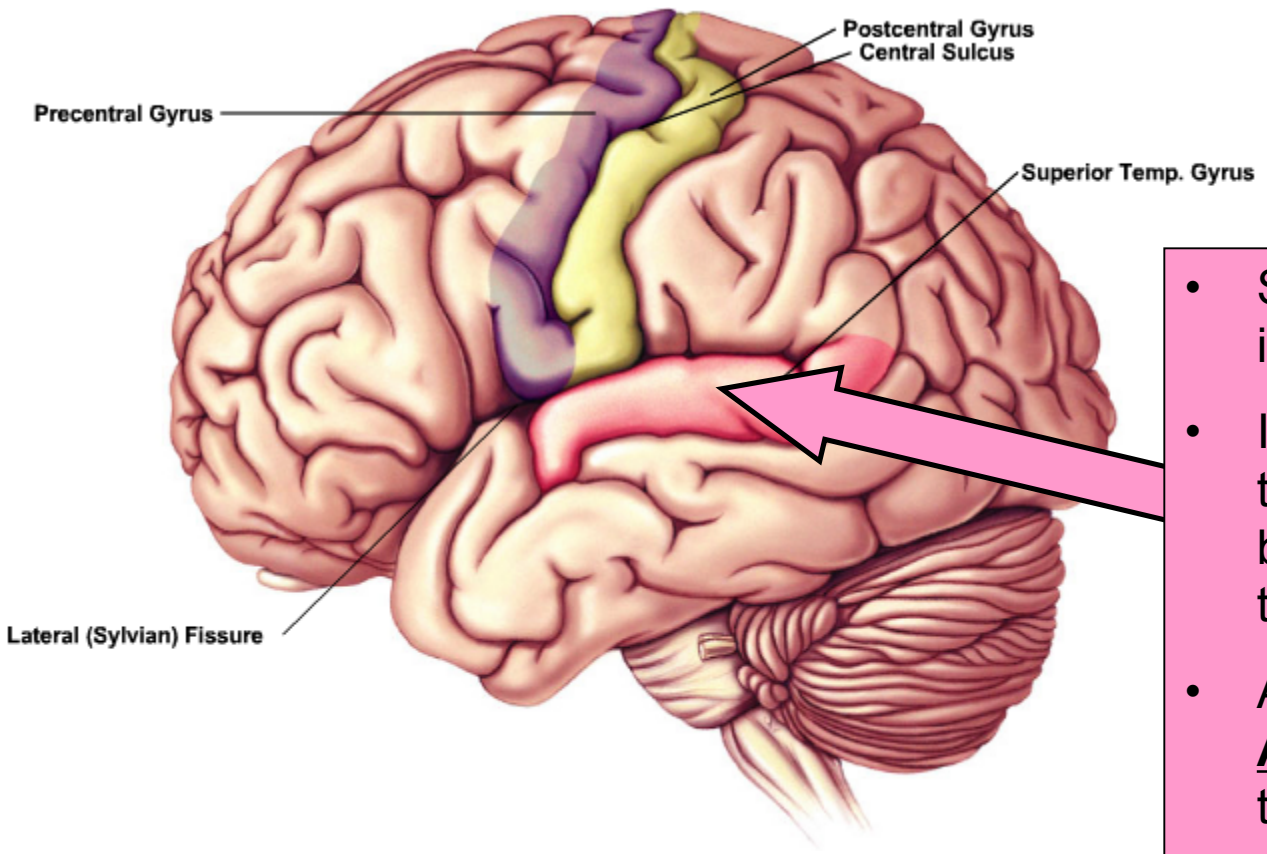


- Light is transduced in the **retina**
- Information arrives in **Primary Visual Cortex** via thalamic relay (LGN)
- **Retinotopic** map

Ventral "what" Stream:
Object identification

Interactive Guide to Human Neuroanatomy; Bear Connors & Paradiso (2003)

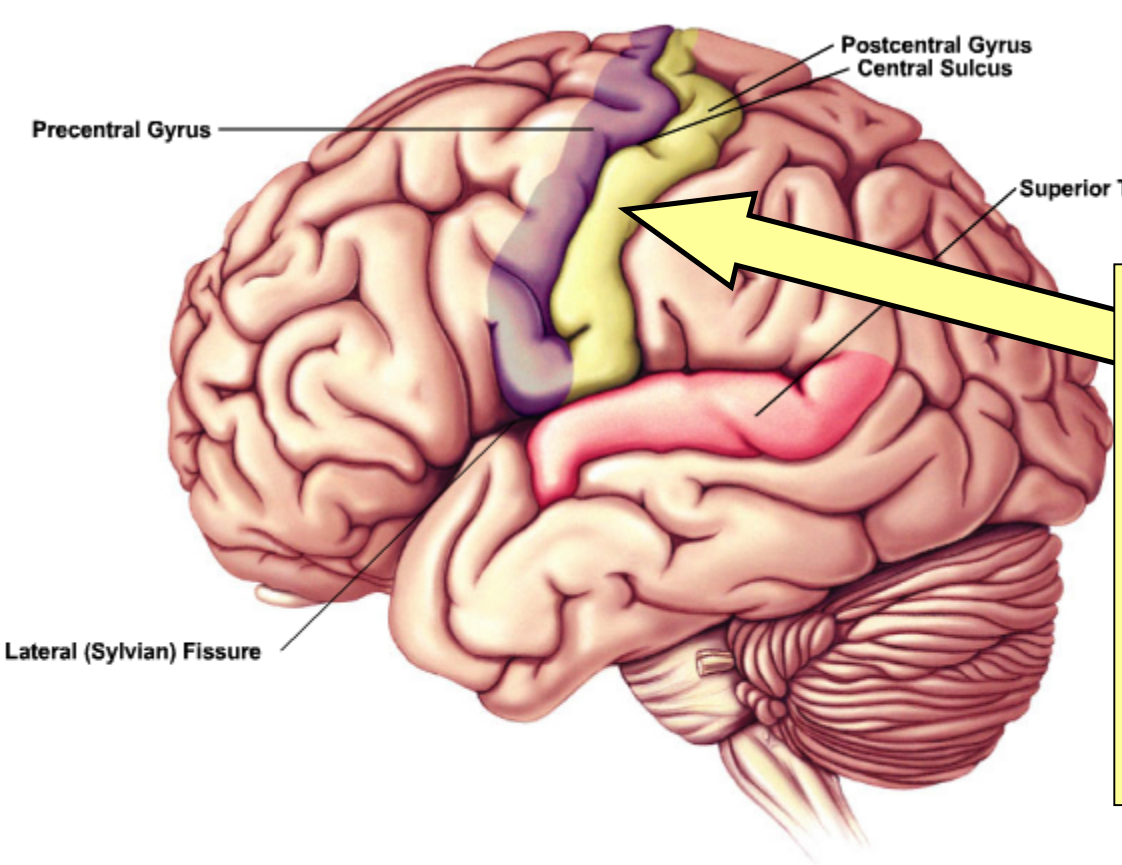
Sensory Systems: Hearing



- Sound is transduced in the **cochlea**
- Information passes through several brainstem and thalamic nuclei
- Arrives in **Primary Auditory Cortex** in temporal lobe
- **Tonotopic** map

Interactive Guide to Human Neuroanatomy; Bear Connors & Paradiso (2003)

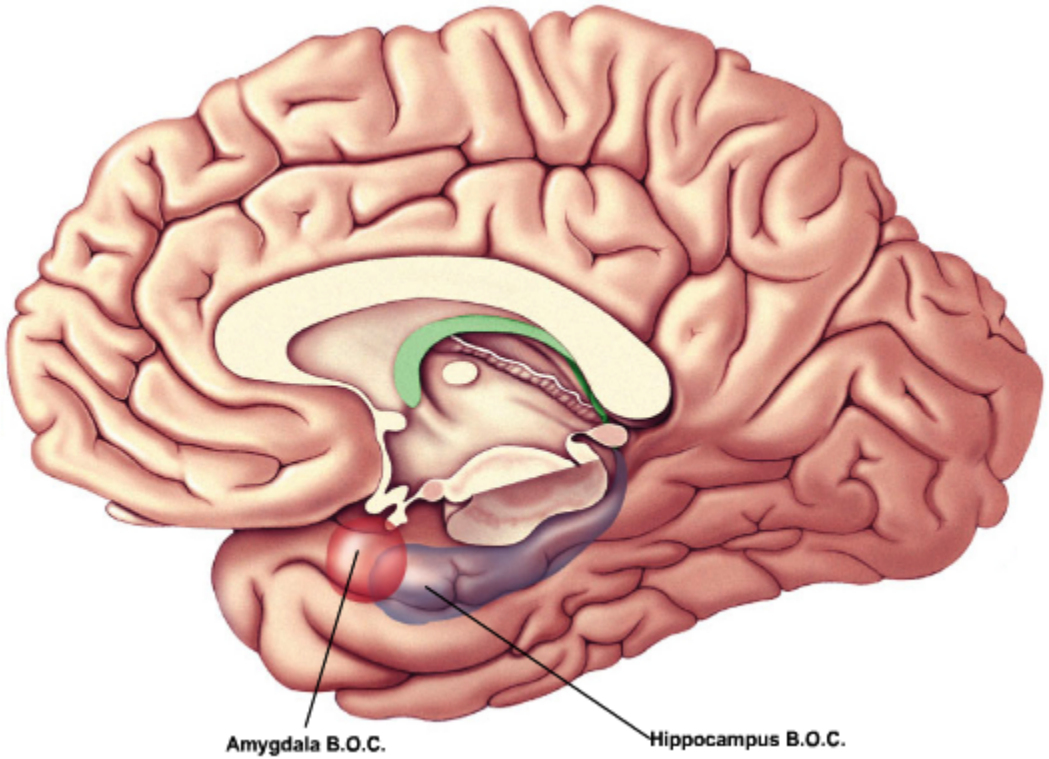
Sensory Systems: Touch



- Sensory receptors in the skin respond to pain, pressure, temperature
- Information arrives in **Primary Somatosensory Cortex** in parietal lobe via spinal cord and thalamus
- **Somatotopic** map

Interactive Guide to Human Neuroanatomy; Bear Connors & Paradiso (2003)

Memory & Arousal: Hippocampus & Amygdala



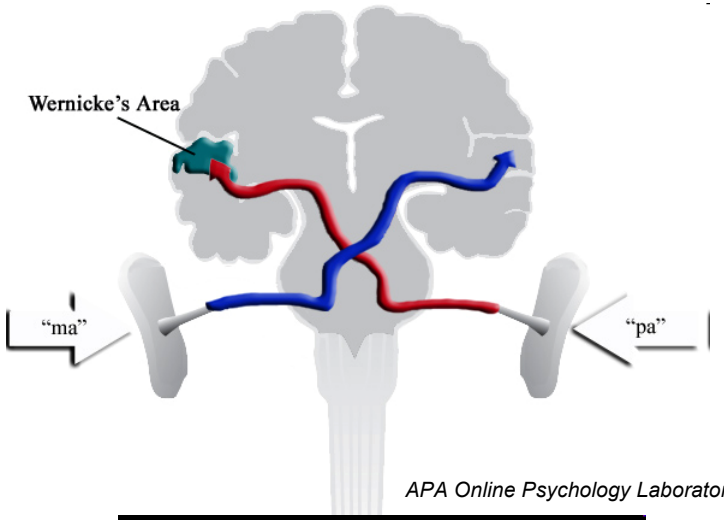
B.O.C. = below overlying cortex

- **Hippocampus**: necessary for making new long-term memories
  - Patient H.M.
  - Korsakoff's syndrome
  - Spatial maps
- **Amygdala**: Like the "gatekeeper" to the brain; orients attention towards important stimuli
  - Angry faces
  - Frightening sounds

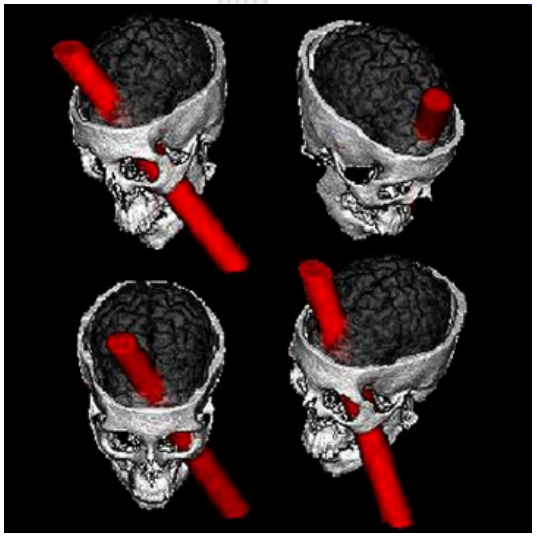
Interactive Guide to Human Neuroanatomy; Bear Connors & Paradiso (2003)

Methods for studying the human brain

- Basic behavioral assays:
  - Visual hemifields
  - Dichotic listening
- Neuropsychology
  - Lesions
    - Traumatic brain injury
    - Strokes
    - After brain surgery
  - Developmental disorders



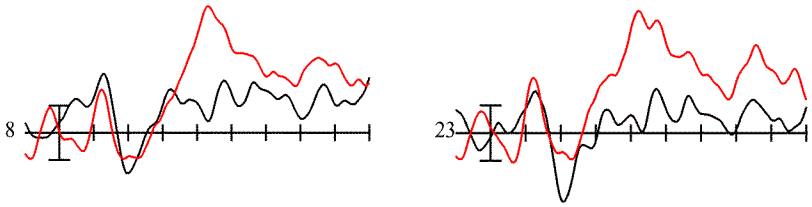
APA Online Psychology Laboratory



http://www.sciencemuseum.org.uk/

Methods for studying the human brain

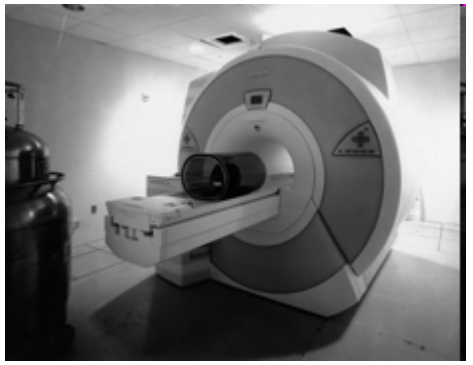
- EEG and MEG
  - Measure electrical and magnetic fields produced by neuronal activity
  - Excellent temporal resolution (milliseconds)
  - Limits on spatial resolution

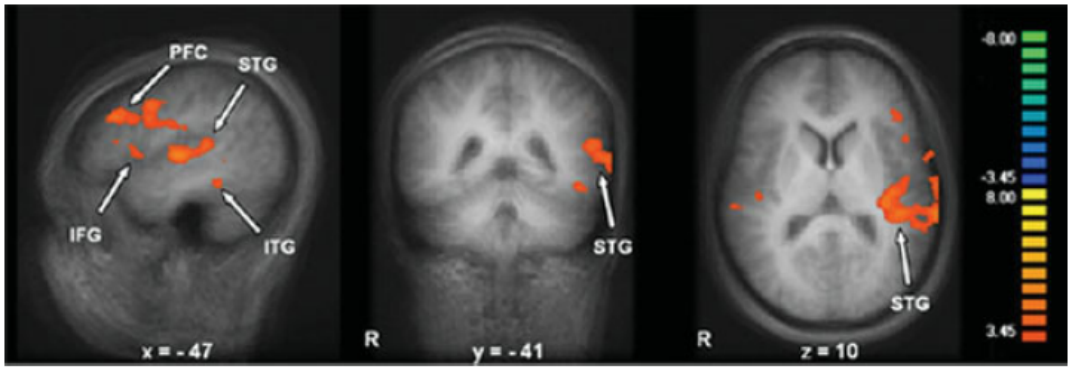


Top: Patricia O'Loughlin, Harvard
Bottom: Marianna Eddy, MIT

Methods for studying the human brain

- fMRI and PET
  - Measure metabolism (e.g. blood flow) associated with underlying neural activity
  - Good spatial resolution (millimeters)
  - Limits on temporal resolution (14sec "hemodynamic response")





Top: http://web.mit.edu/gabrieli-lab/imaging.htm
Bottom: Wong, Perrachione, Parrish (2007) HBM

Using the brain to understand the mind

Researchers created a list of facts that about 50% of people knew. Subjects in this experiment read the list of facts and had to say which ones they knew. They then had to judge what percentage of other people would know those facts.

Researchers found that the subjects responded differently about other people's knowledge of a fact when the subjects themselves knew that fact. If the subjects did know a fact, they said that an inaccurately large percentage of others would know it, too. For example, if a subject already knew that Hartford was the capital of Connecticut, that subject might say that 80% of people would know this, even though the correct answer is 50%. The researchers call this finding ‘‘the curse of knowledge.

A good explanation?

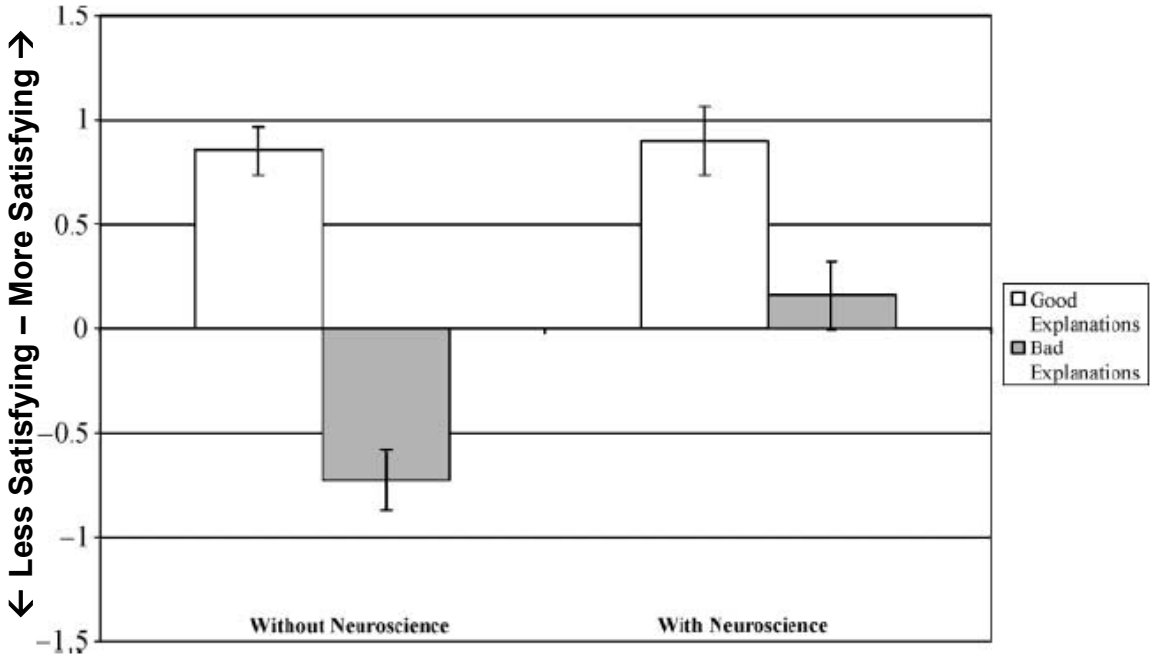
- The researchers claim that this ‘‘curse’’ happens because subjects have trouble switching their point of view to consider what someone else might know, mistakenly projecting their own knowledge onto others.

A good explanation?

- Brain scans indicate that this "curse" happens because of the frontal lobe brain circuitry known to be involved in self-knowledge. Subjects make more mistakes when they have to judge the knowledge of others. People are much better at judging what they themselves know.

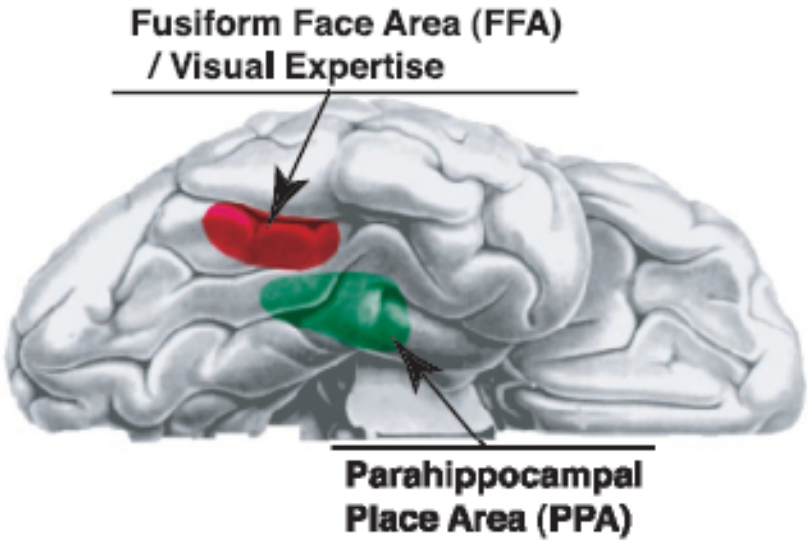
“The Seductive Allure of Neuroscience Explanations"

- Weisberg et al. (2008) J. Cognitive Neuroscience
- “The neuroscience information had a particularly striking effect on nonexperts’ judgments of bad explanations, masking otherwise salient problems in these explanations.”



Discussion

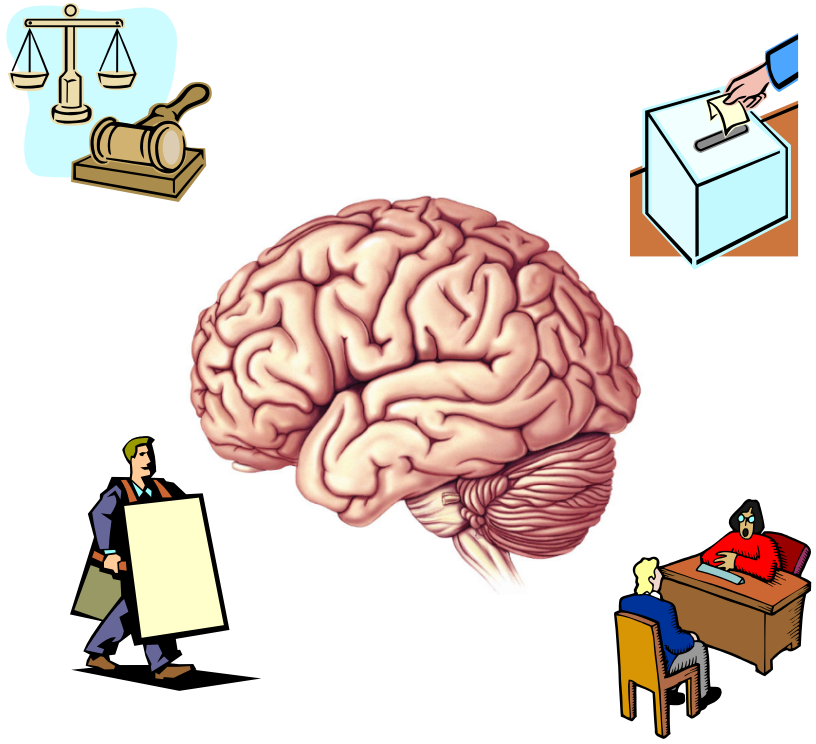
- What kinds of evidence does it take to say a particular brain region is really responsible for / implicated in any given psychological phenomena?
- Is the brain responsible for all human behavior? What kind of evidence would convince you there was a behavior that the brain didn't produce or control?



Haxby et al. (2001) Science

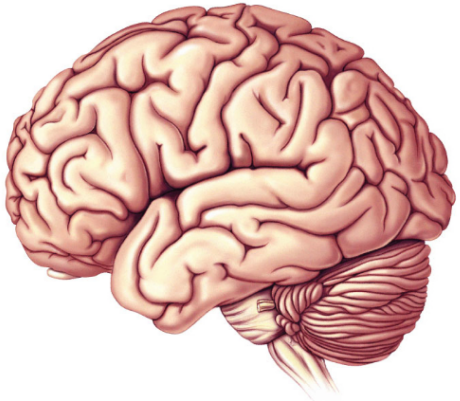
Discussion

- What are the implications of brain imaging technology moving into other fields?
  - Law
  - Marketing
  - Politics
  - Business & Hiring



Discussion

- When do we need to think about the brain in developing a psychological explanation?
  - What does a description at a “neural level” give us beyond a description at a “behavioral level”?



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http://www.formfunctionemotion.net/i/rat_in_maze.jpg