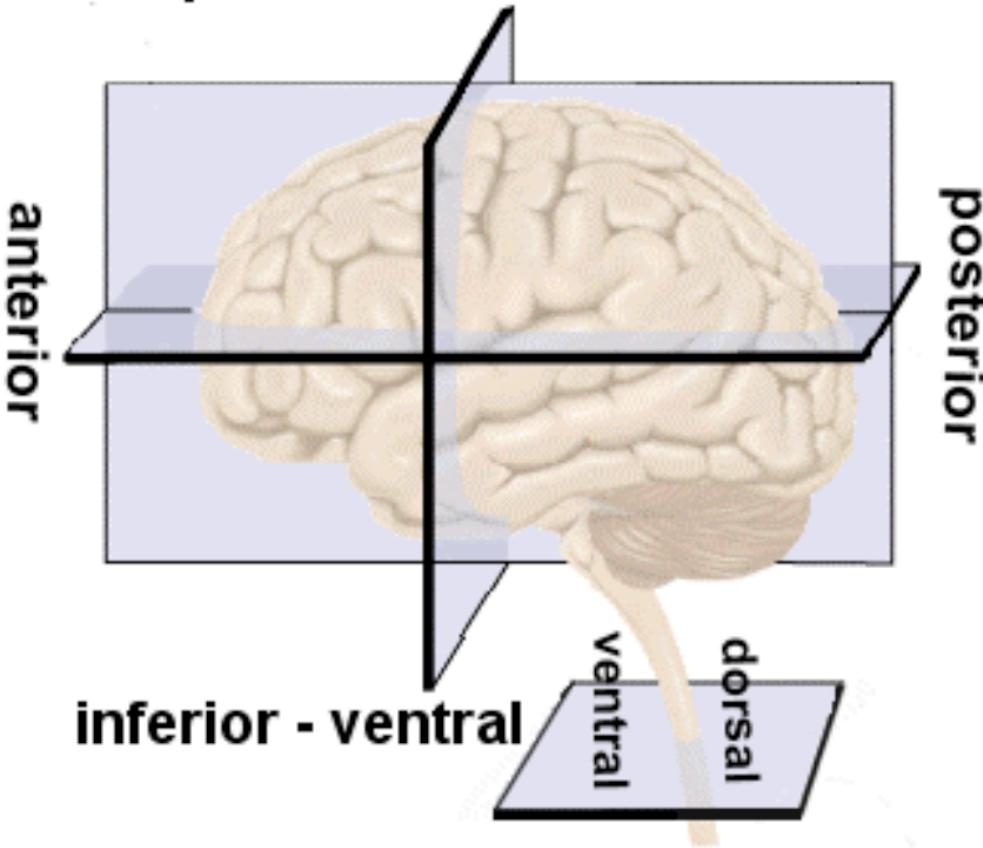


# Introduction to Brain Anatomy

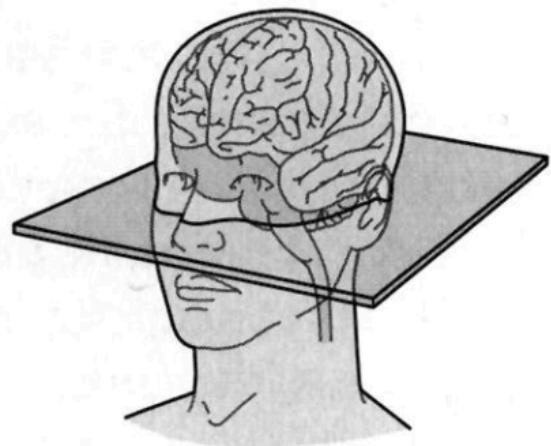
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27 June 2016

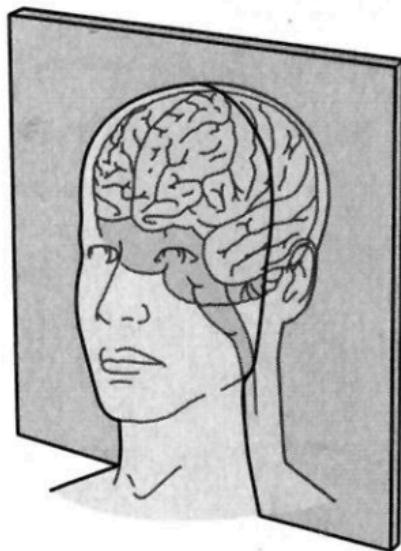
**superior - dorsal**



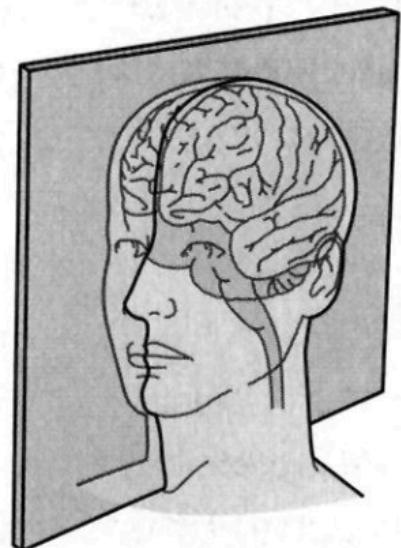
Horizontal plane



Coronal plane



Sagittal plane



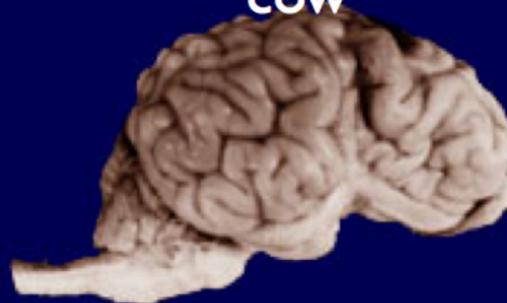
human



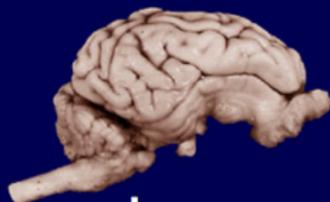
chimp



cow



pig



dog



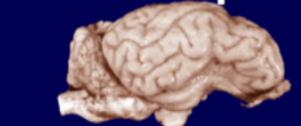
macaque



cat



sheep



rat



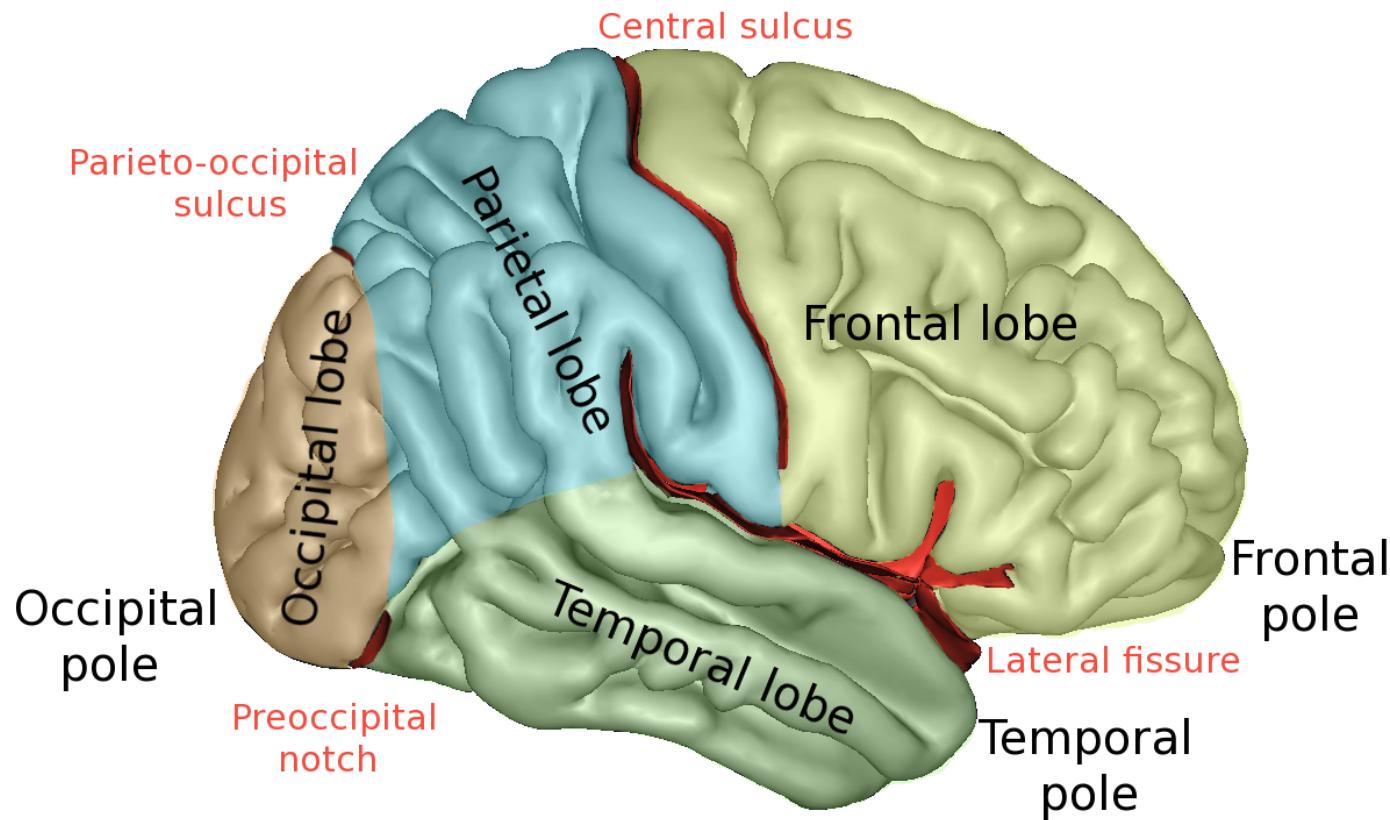
mouse



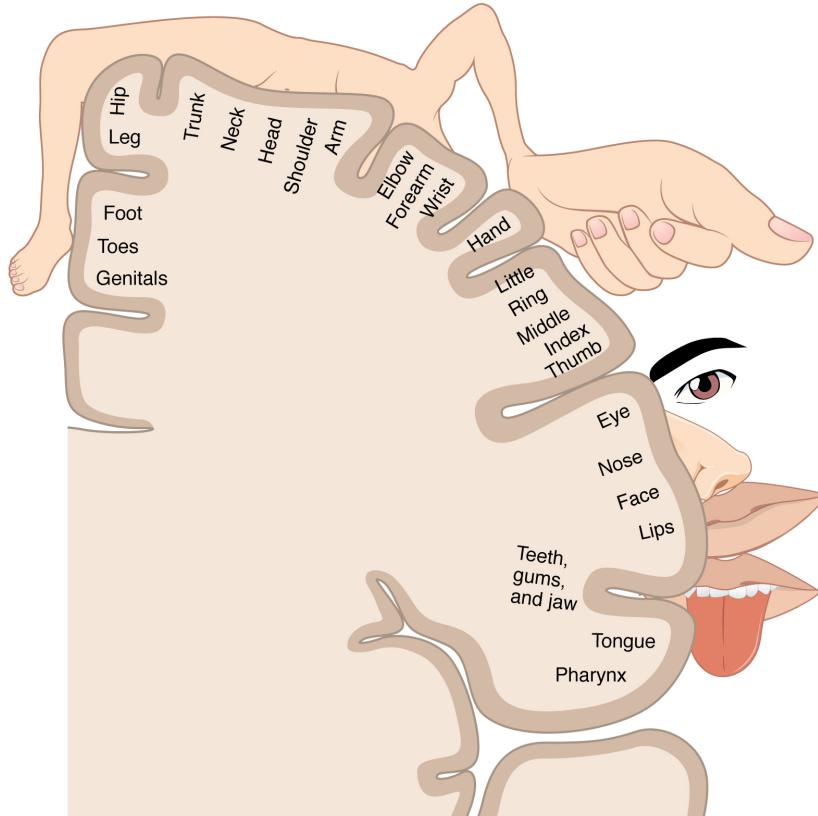
## Fun facts:

- Sperm whale brain is >6 times larger than human
- Human brain weighs just 3 lbs but consumes 20-25% of all energy!
- Many cases of people born with only half a brain functioning virtually normally

# Major Subdivisions



# Homunculus (little man)



## Motor Strip:

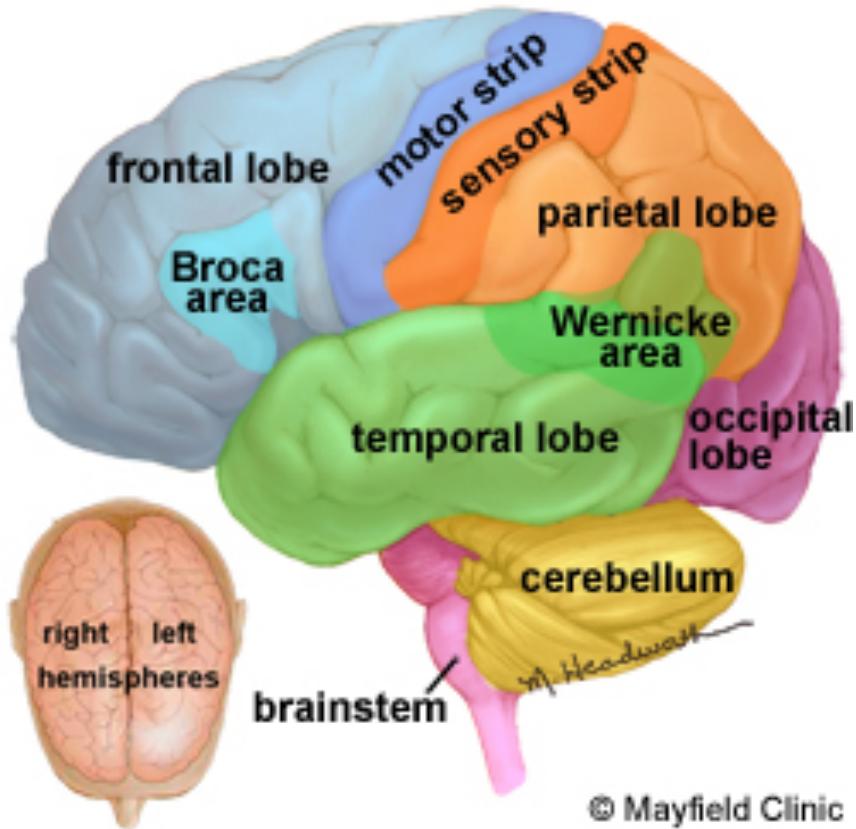
- Pre-central gyrus (i.e., anterior of Central Sulcus)
- Motor control

## Sensory Strip:

- Post-central gyrus (i.e., posterior of Central Sulcus)
- Touch sensory processing

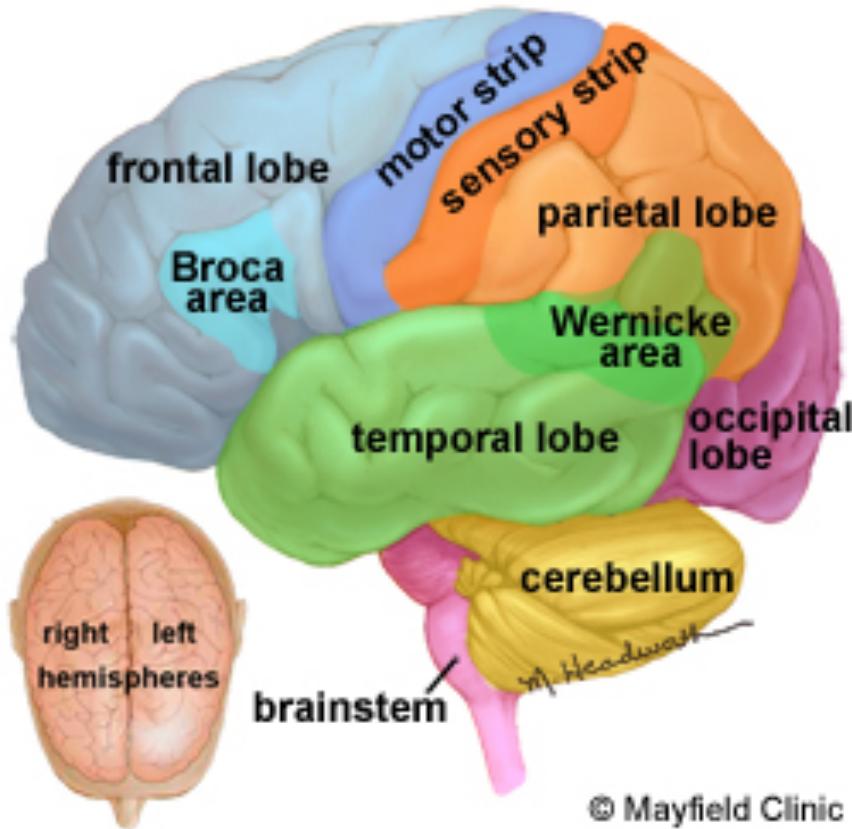
**Size of body part  
indicates relative amount  
of cortical real estate  
devoted to that body part**

# Frontal Lobe



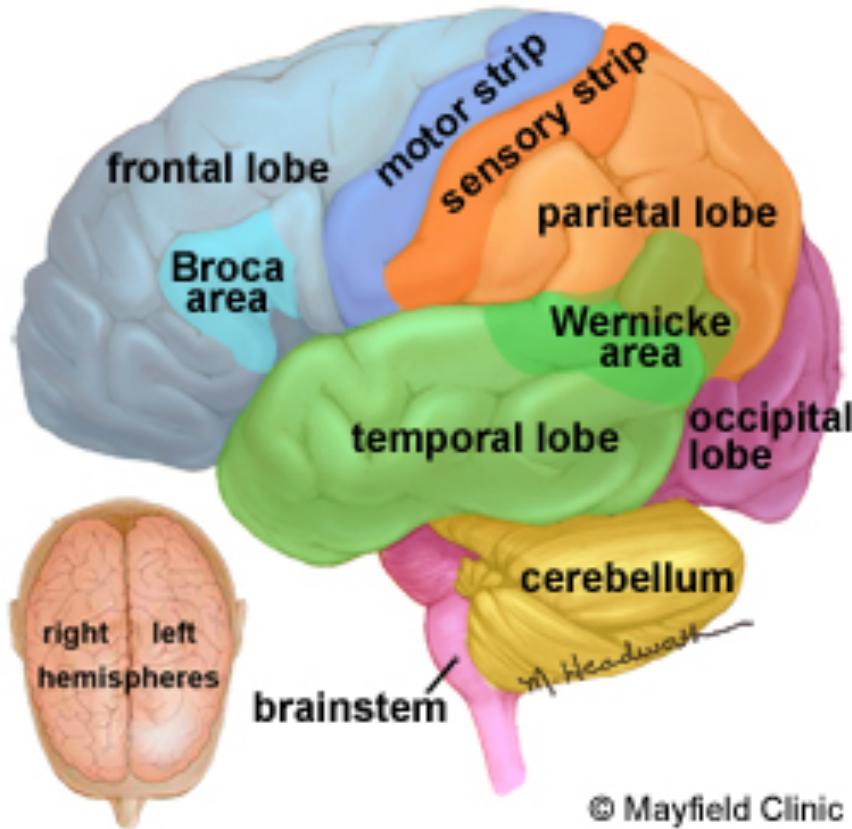
- Personality, behavior, emotions
- Judgment, planning, problem solving
- Speech: speaking and writing (***Broca's area***)
- Body movement (motor strip)
- Intelligence, concentration, self awareness

# Parietal Lobe



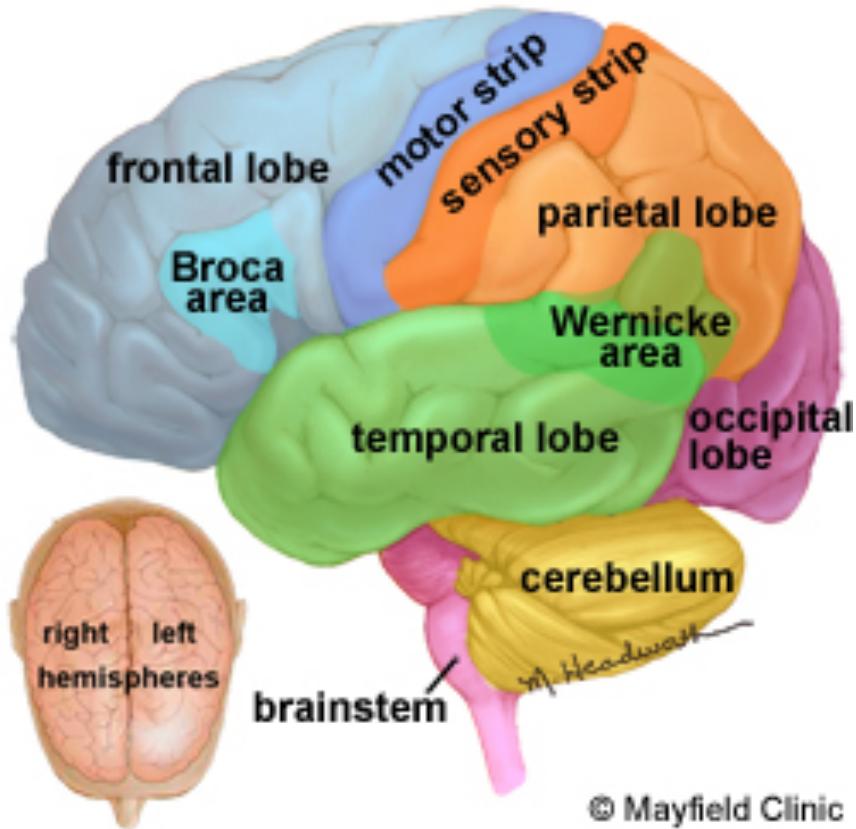
- Interprets language, words
- Sense of touch, pain, temperature (sensory strip)
- Interprets signals from vision, hearing, motor, sensory and memory
- Spatial and visual perception
- ***Integration!!***

# Temporal Lobe



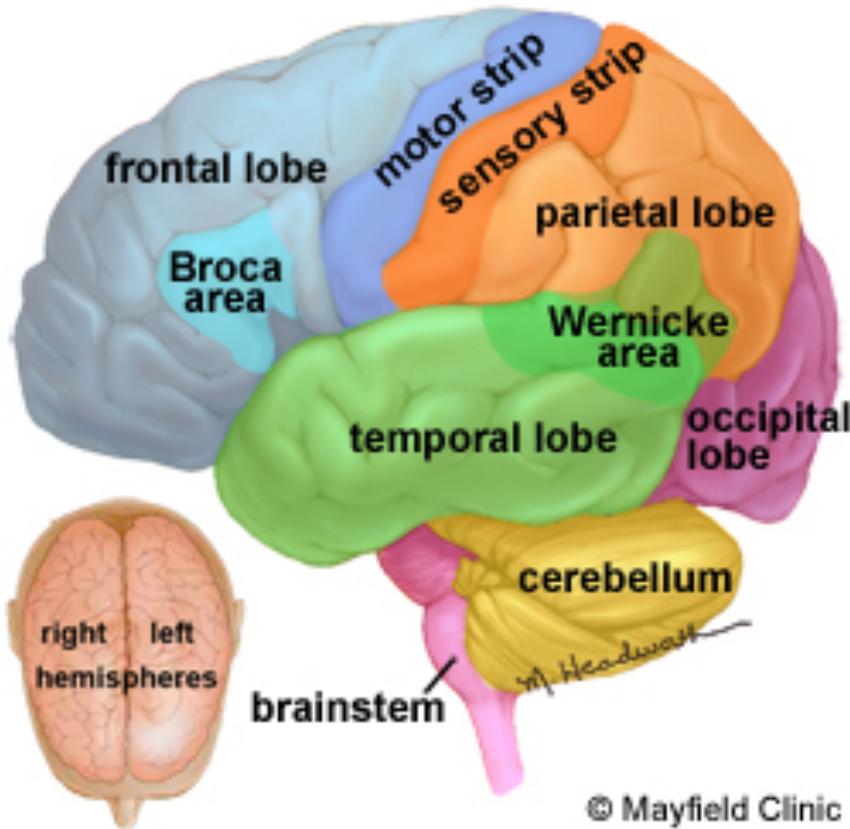
- Understanding language (*Wernicke's area*)
- Memory
- Hearing
- Sequencing and organization

# Occipital Lobe



- Interprets vision (color, light, movement)

# Cerebellum



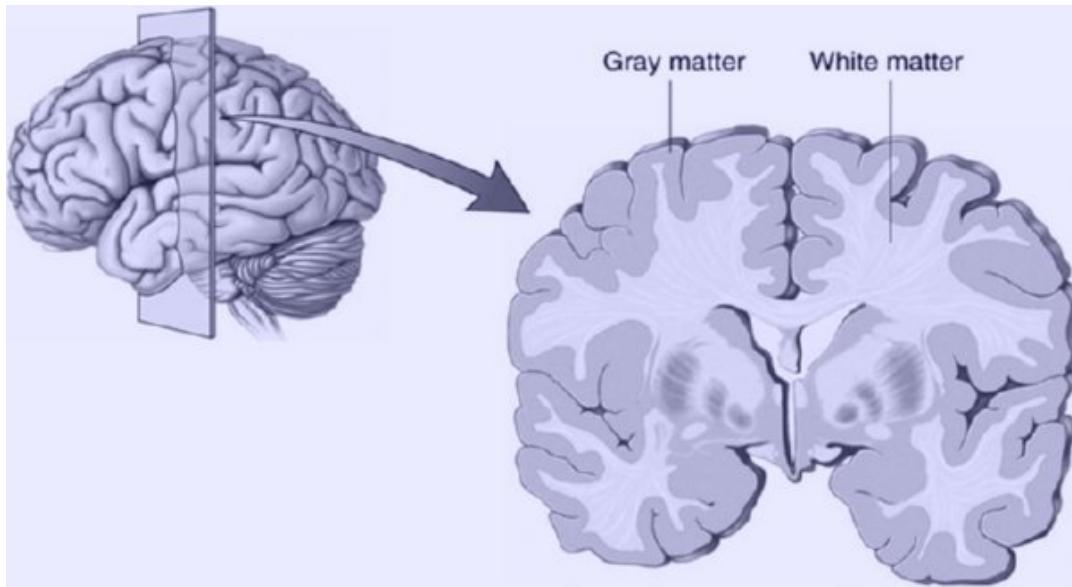
## Old School:

- Only involved in motor related activities such coordination, timing, and learning
- *Wikipedia entry still focuses on this aspect!*

## Current:

- Involved in everything including cognition, emotion processing, etc!!

# Gray Matter, White Matter, CSF



## Gray Matter:

- Mostly cortical mantle
- Subcortical nuclei also considered gray matter
- Consists of neurons, glia, synapses, etc

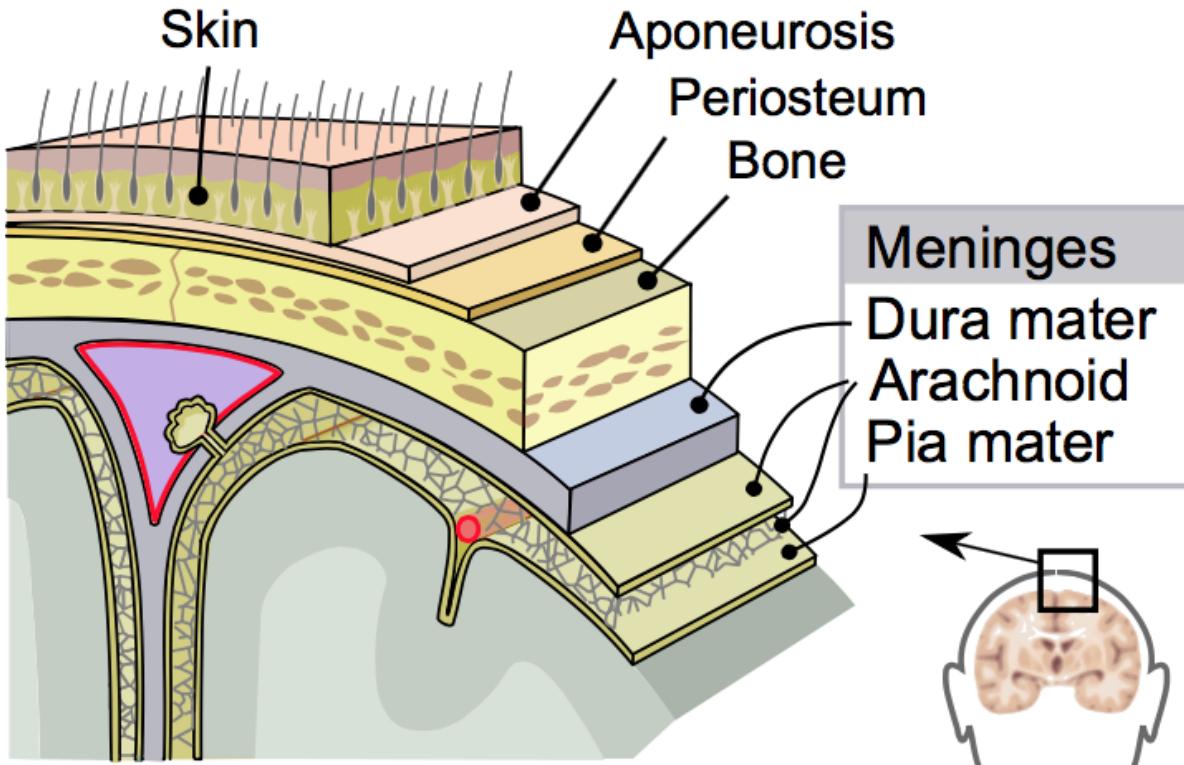
## White Matter:

- Axons
- Connections between neurons
- “Wiring” of the brain

## CSF (Cerebrospinal fluid):

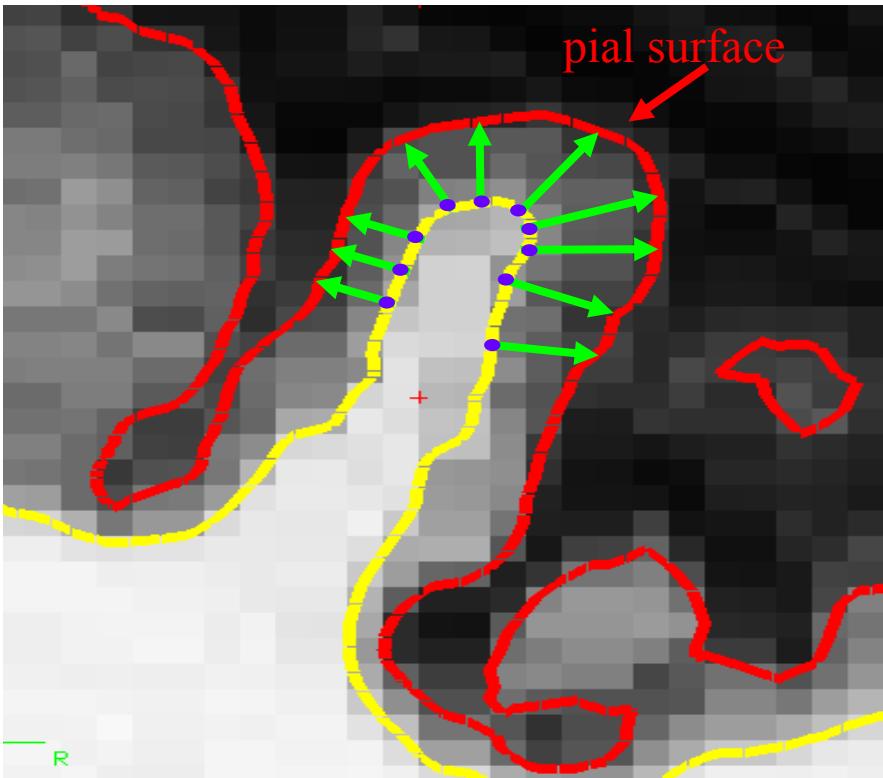
- Cushions brain
- Immunology protection

# Meninges



- Three membranes: dura mater, the arachnoid mater, and the pia mater
- Envelops the brain and spinal cord
- Cerebrospinal fluid located in space between arachnoid mater and pia mater
- Primary function of the meninges is to protect the central nervous system
- **Pia mater located right on top of Gray Matter!**

# Cortical Thickness – Our Goal This Summer!!



- Cortical thickness – thickness of the gray matter in the cortical mantle
- Measured as distance between gray matter and white matter (yellow boundary) to the gray matter and pial surface (red boundary)
- *FreeSurfer software semi-automatically calculates both boundaries and then the measures the thickness*
- *Unfortunately it makes errors especially in red boundary!*



# Introduction to Adolescent Development Study (ADS)

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27 June 2016

# Aims/Goals of the Adolescent Development Study (ADS)

Aim 1: Identify neurodevelopmental factors that predict the initiation/escalation of substance use

Aim 2: Developmental Impact of Substance Use

Expanded to also examine:

- Genetics and epigenetics
- Environmental factors: dietary factors (omega3 fatty acids and iron) and alcohol related advertising

# ADS Study Design

|        | Wave1        | Wave2        | Wave3        |
|--------|--------------|--------------|--------------|
| N:     | 135          | 111          | ~105         |
| Age:   | 11.0-13.0 yo | 12.5-14.5 yo | 14.0-16.0 yo |
| Users: | 0            | 19           | 32           |



## Adolescent Measures (~6 hrs)

MRI Structural & Functional (~1.5 hrs)  
DTI MRI (white matter integrity)  
fMRI – Continuous Performance Task  
fMRI – Wheel of Fortune Task  
fMRI – Emotional Counting Stroop  
fMRI – Resting State  
High resolution structural (**cortical thickness**, volume)

Outside scanner (~4.5 hrs)  
Temporal Discounting, Facial Emotion recognition Task  
KBIT, Trail Making, Spatial WM, Stockings of Cambridge  
DUSI (Drug Use Survey Instrument)  
Diet assessment (relative DHA intake)  
Alcohol advertising exposure

## Parent Measures (~2 hrs)

Demographics, factors related to Social Economic Status (SES)  
AUDIT (self report of alcohol use)  
Family History of Drug/Alcohol Use  
Perinatal questionnaire  
BRIEF (parent report of child's executive function and impulsivity)  
ADHD Rating Scale (parent rating of child)  
Temperament Scale (parent rating of child)

# ADS Sample Characteristics

Sample of 142 adolescents very representative of the racial and SES makeup of the D.C. metro region

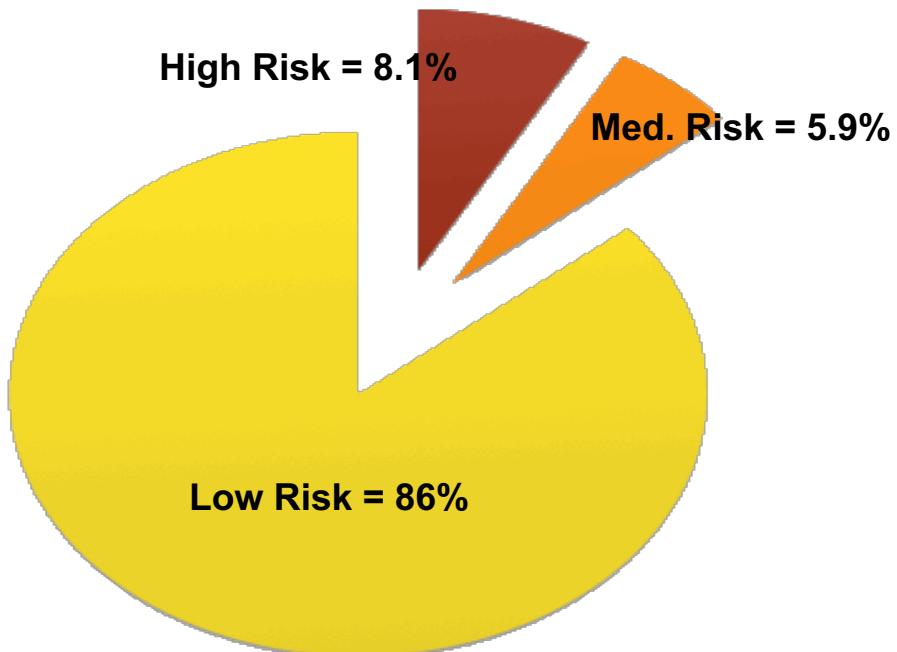
Wave 2 111 completed (>82%)

Wave 3 108 completed (last ones tested this past weekend!)

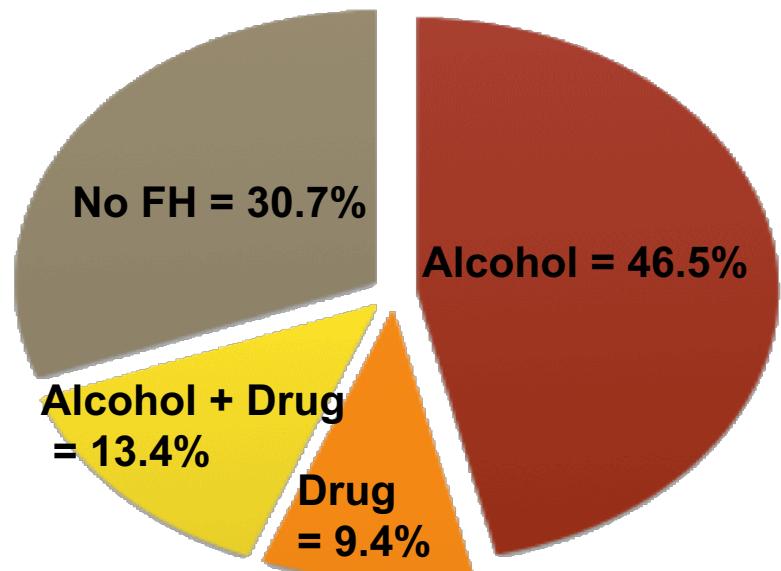
|  |                     |
|--|---------------------|
| N  | 135 (73F,62M)       |
| Age  | 12.7(0.8)           |
| Pubertal status                            | 2.2(0.70)           |
| Race and Ethnicity                         |                     |
| African American                           | 45 (33%)            |
| Caucasian                                  | 70 (51.9%)          |
| Hispanic/Latino                            | 9 (6.7%)            |
| Other                                      | 11 (8.1%)           |
| Socioeconomic Status                       |                     |
| Parent cumulative years education,<br>mean | 16.2(2.9)           |
| Household income                           |                     |
| Mean                                       | \$50,000 -\$74,999  |
| Median                                     | \$100,000-\$149,000 |
| IQ (KBIT)                                  | 108.8(15.3)         |
| Alcohol Risk distribution (from DUSI-QS)   |                     |
| Low (%)                                    | 116 (85.9%)         |
| Medium (%)                                 | 8 (5.9%)            |
| High (%)                                   | 11 (8.1%)           |

# ADS Sample by Risk

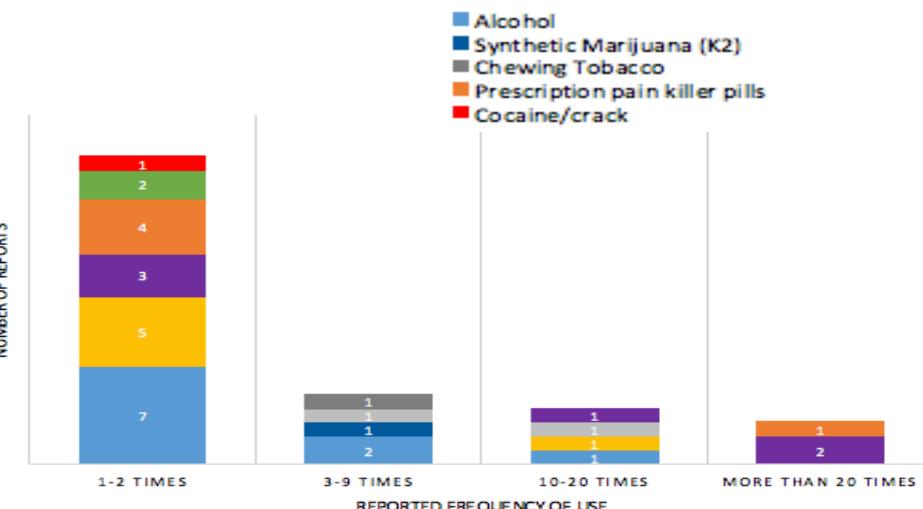
## DUSI-QS\*



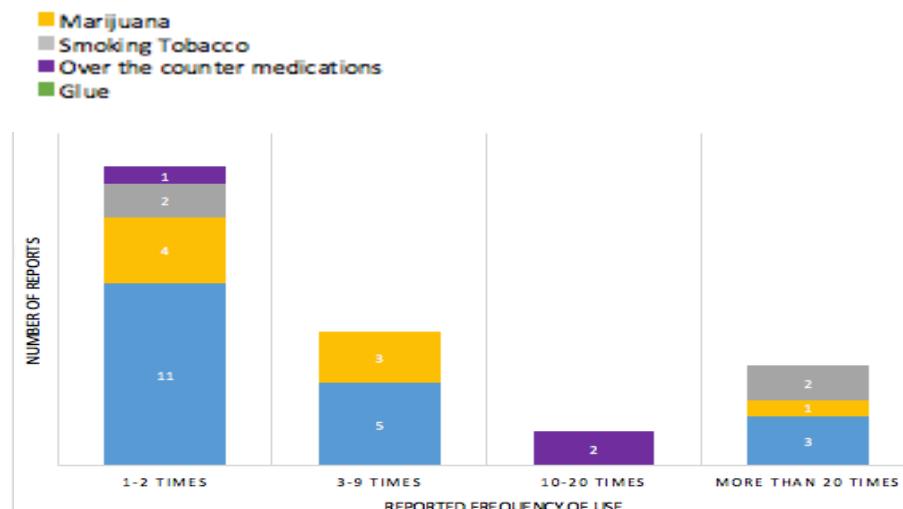
## Family History



# Frequency of Use by Substance



Wave 2



Wave 3