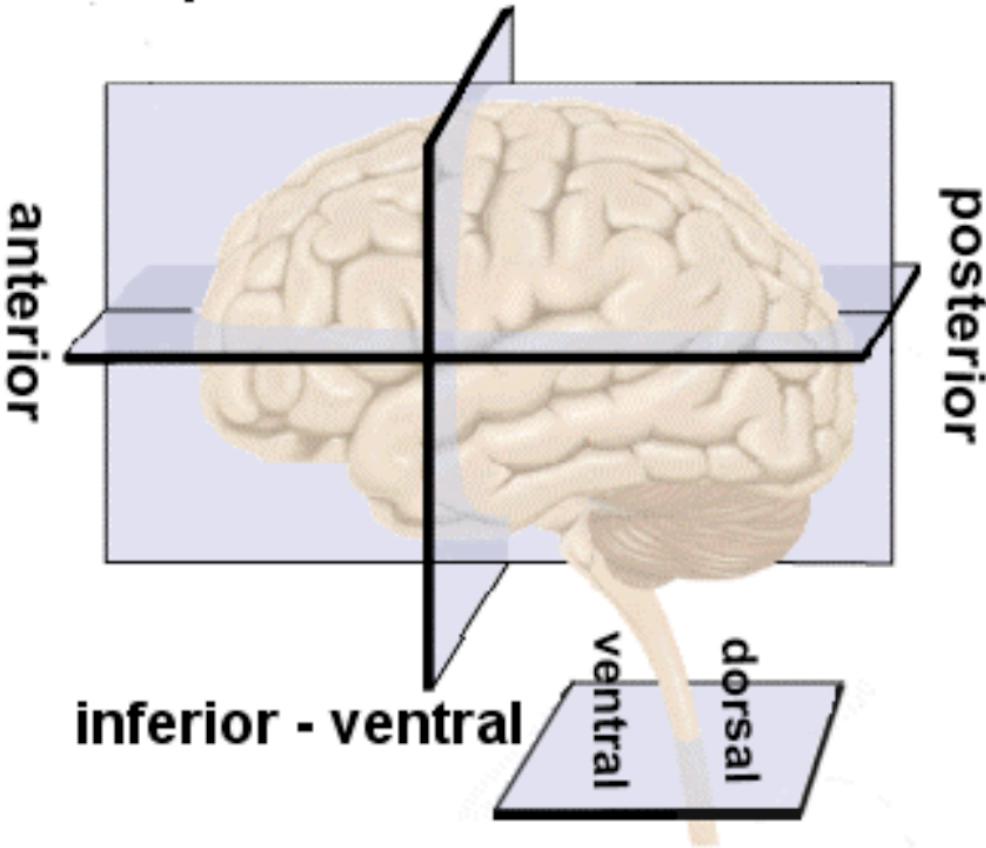


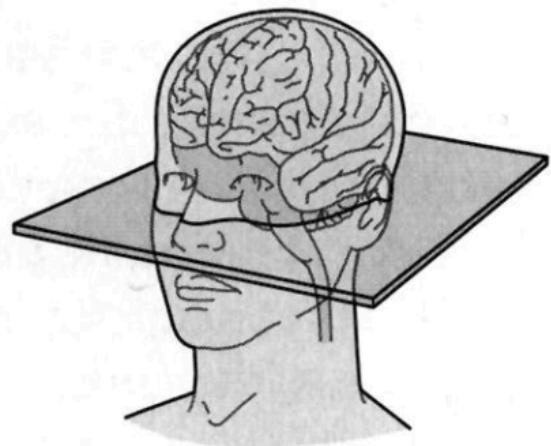
Introduction to Brain Anatomy

27 June 2016

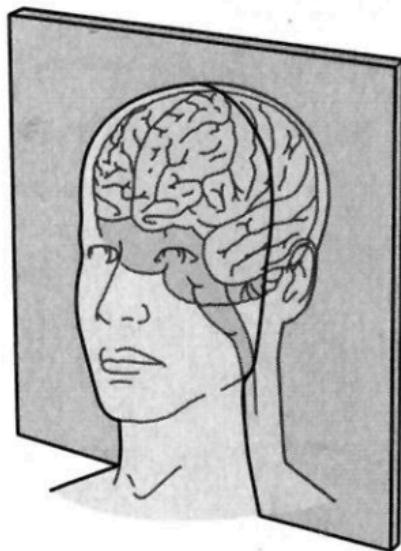
superior - dorsal



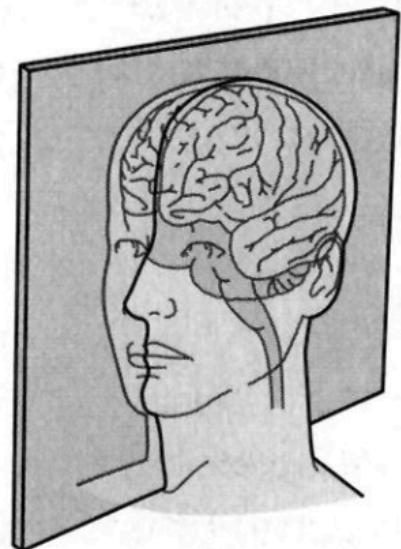
Horizontal plane



Coronal plane



Sagittal plane



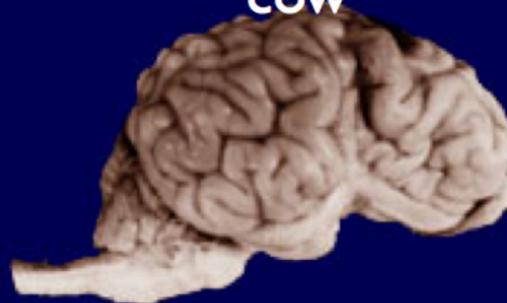
human



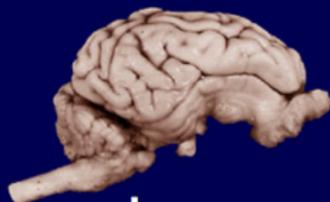
chimp



cow



pig



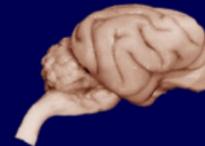
dog



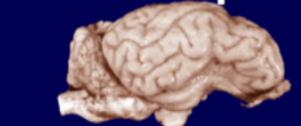
macaque



cat



sheep



rat



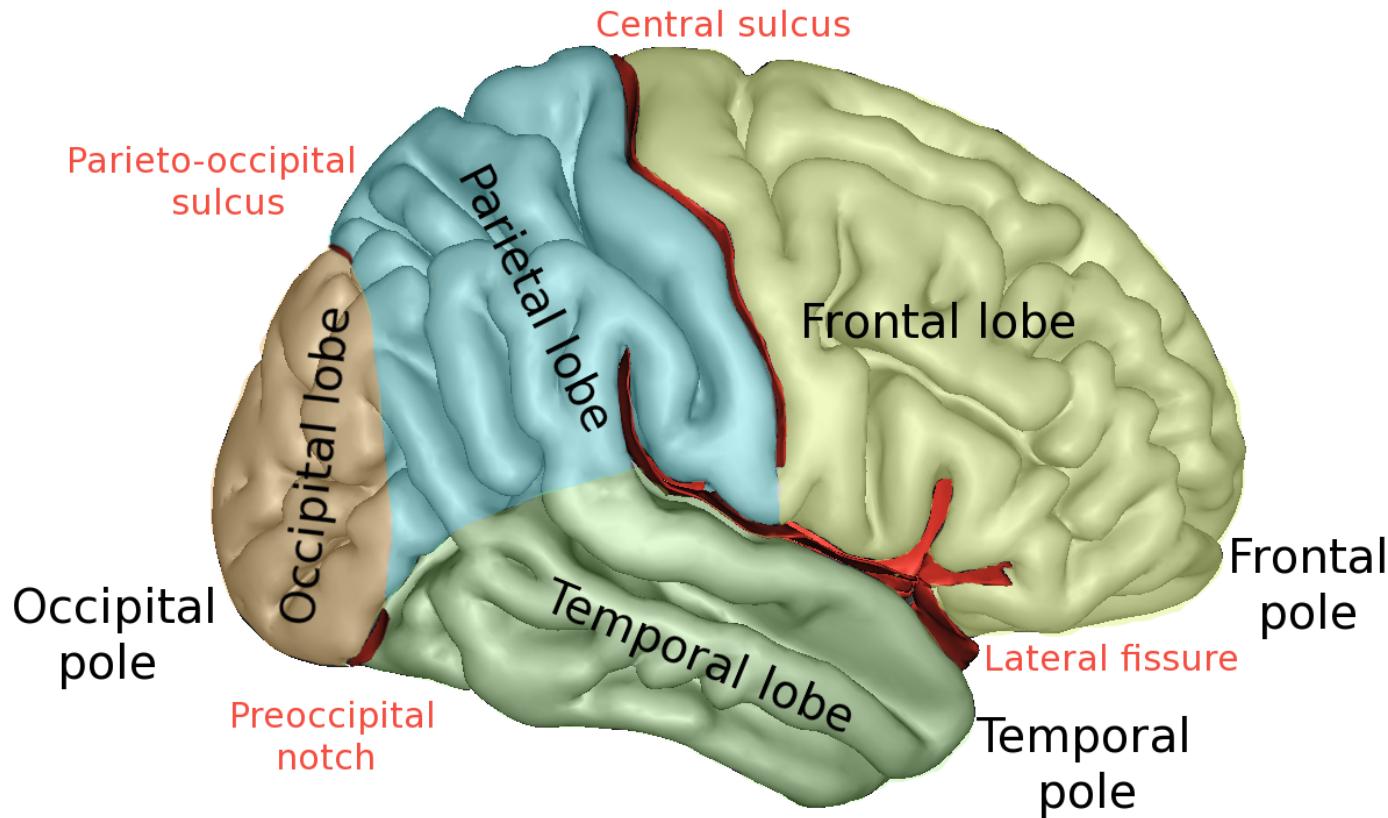
mouse



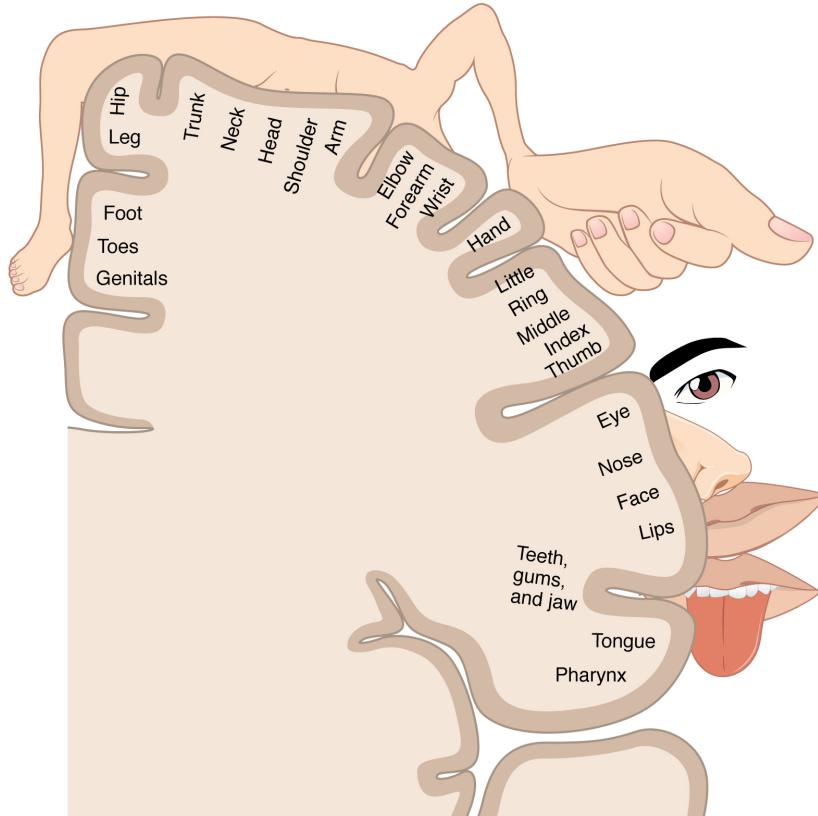
Fun facts:

- 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:

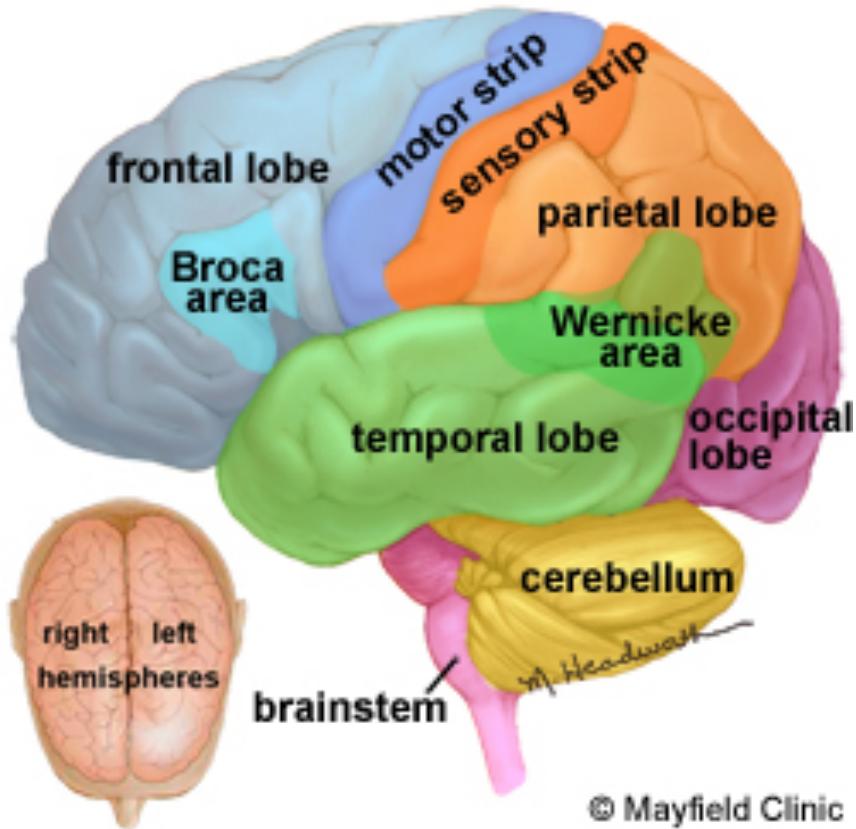
- Pre-central gyrus (i.e., anterior of Central Sulcus)
- Motor control

Sensory Strip:

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

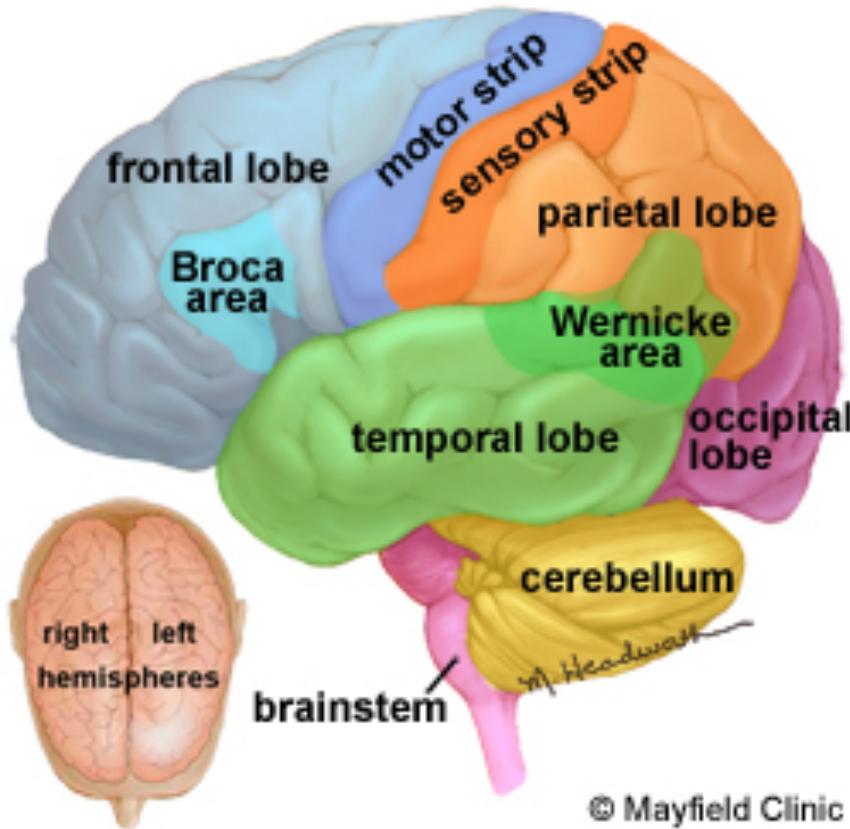
**Size of body part
indicates relative amount
of cortical real estate
devoted to that body part**

Frontal Lobe



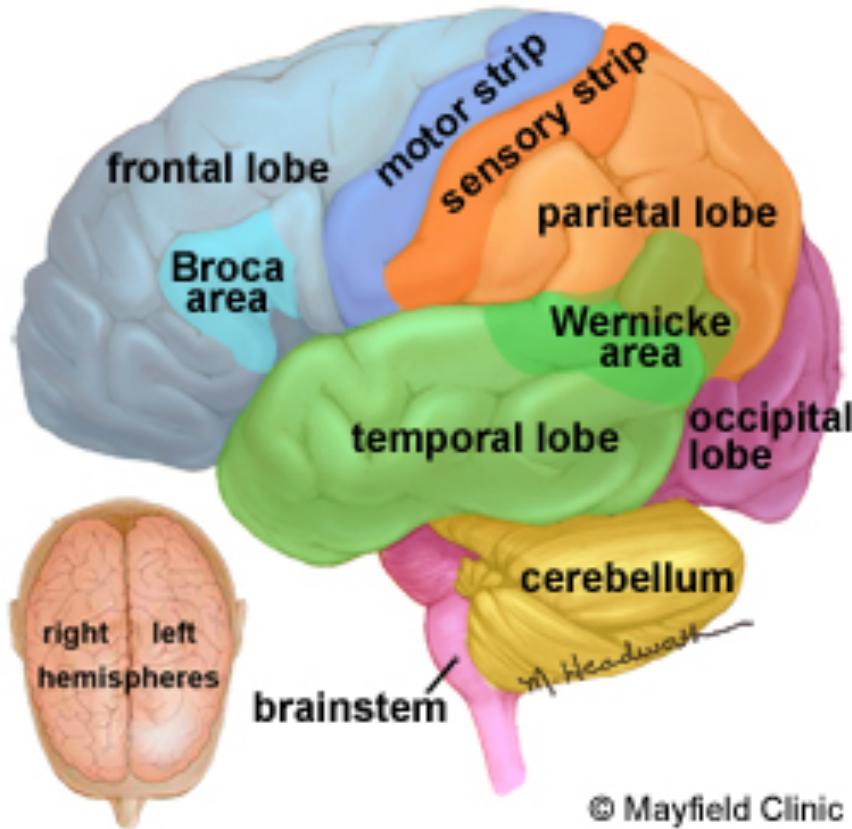
- Personality, behavior, emotions
- Judgment, planning, problem solving
- Speech: speaking and writing (***Broca's area***)
- Body movement (motor strip)
- Intelligence, concentration, self awareness

Parietal Lobe



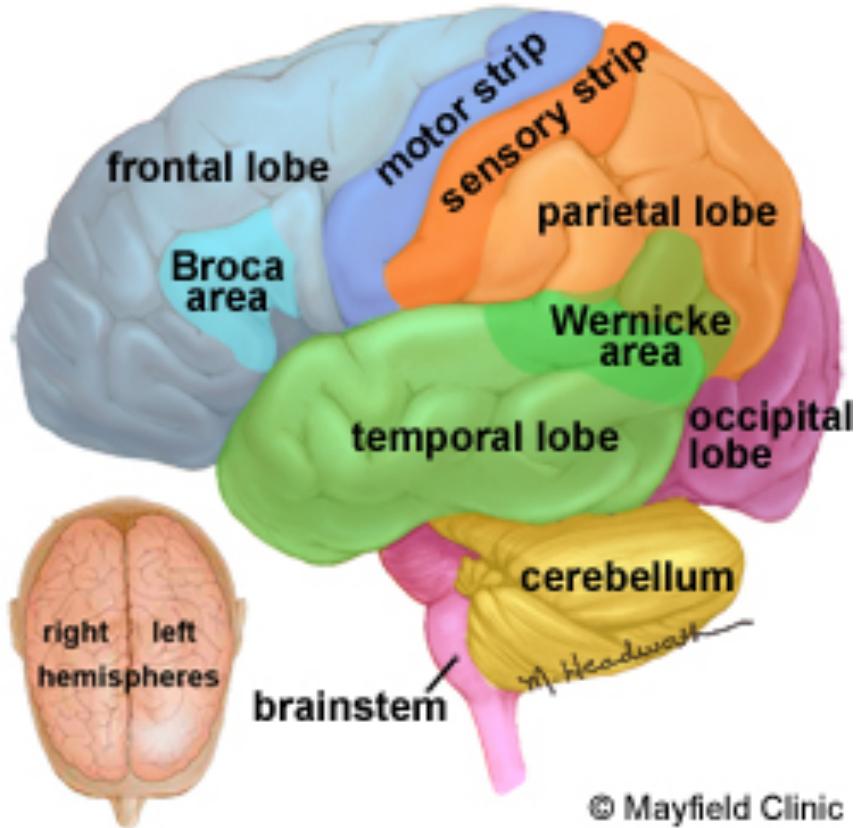
- Interprets language, words
- Sense of touch, pain, temperature (sensory strip)
- Interprets signals from vision, hearing, motor, sensory and memory
- Spatial and visual perception
- ***Integration!!***

Temporal Lobe



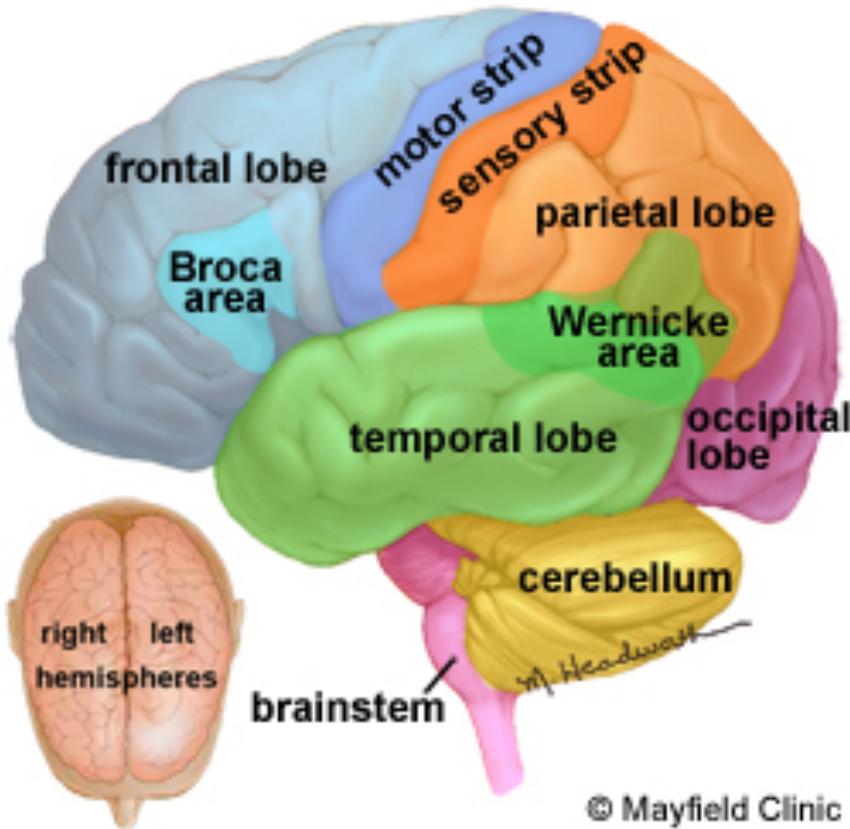
- Understanding language (*Wernicke's area*)
- Memory
- Hearing
- Sequencing and organization

Occipital Lobe



- Interprets vision (color, light, movement)

Cerebellum



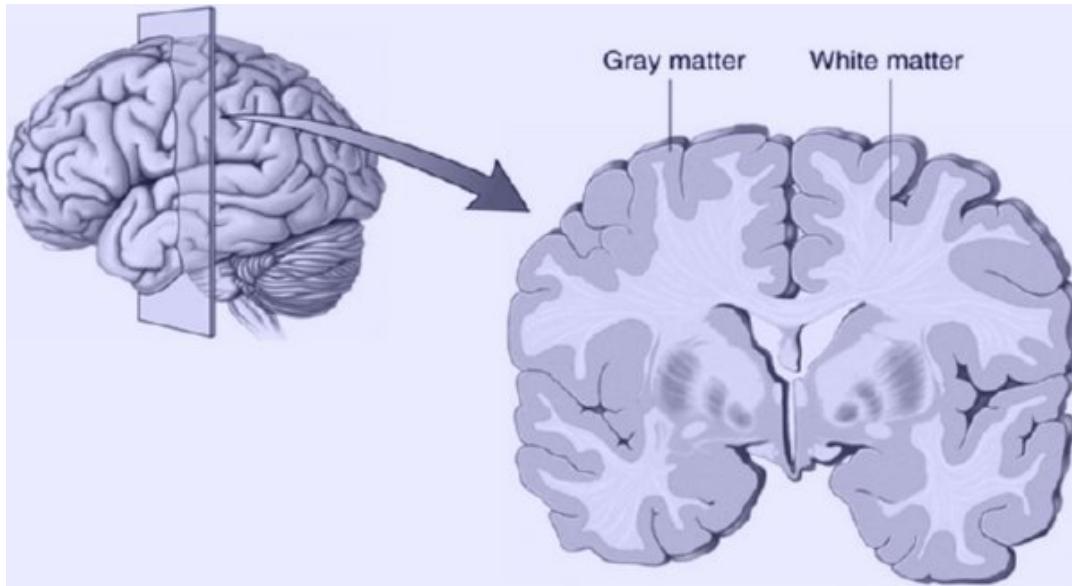
Old School:

- 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

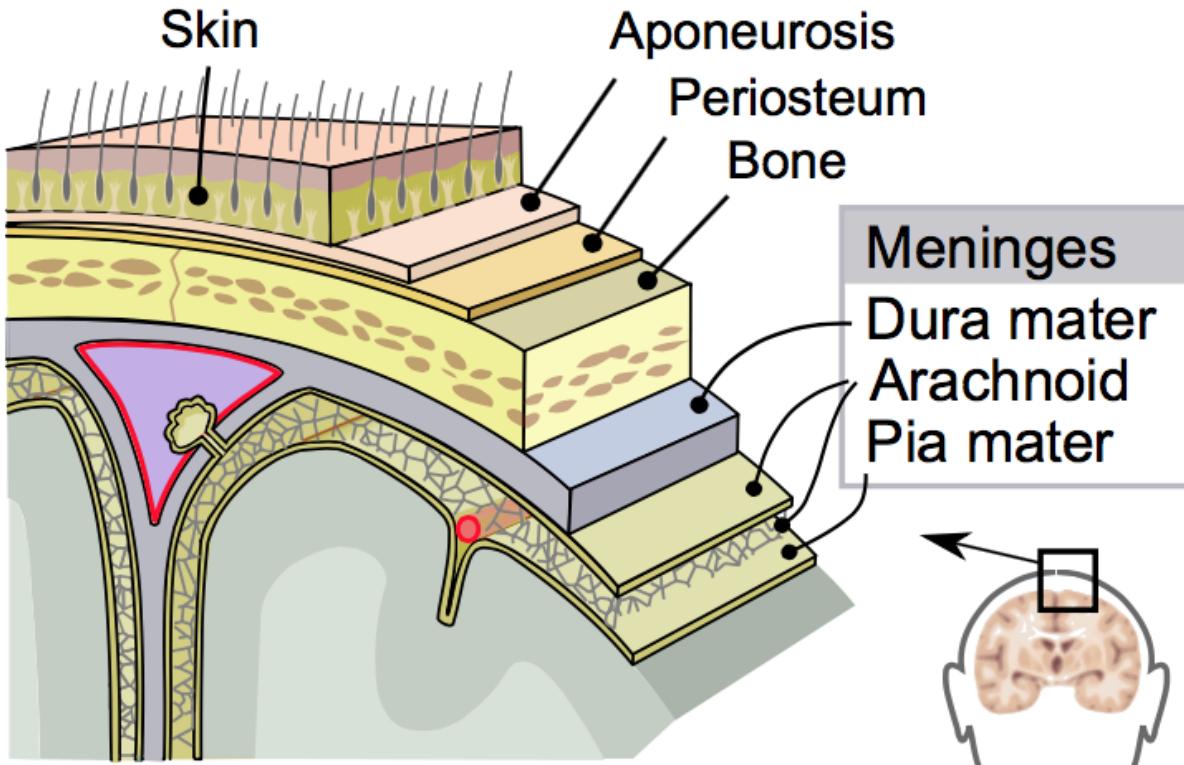
White Matter:

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

CSF (Cerebrospinal fluid):

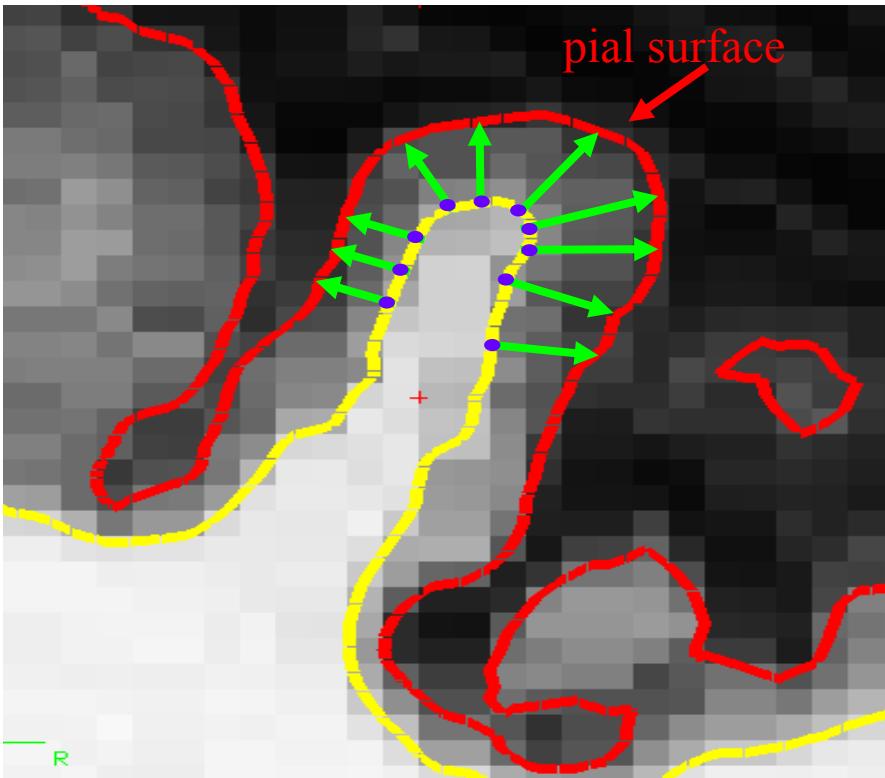
- Cushions brain
- Immunology protection

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)

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

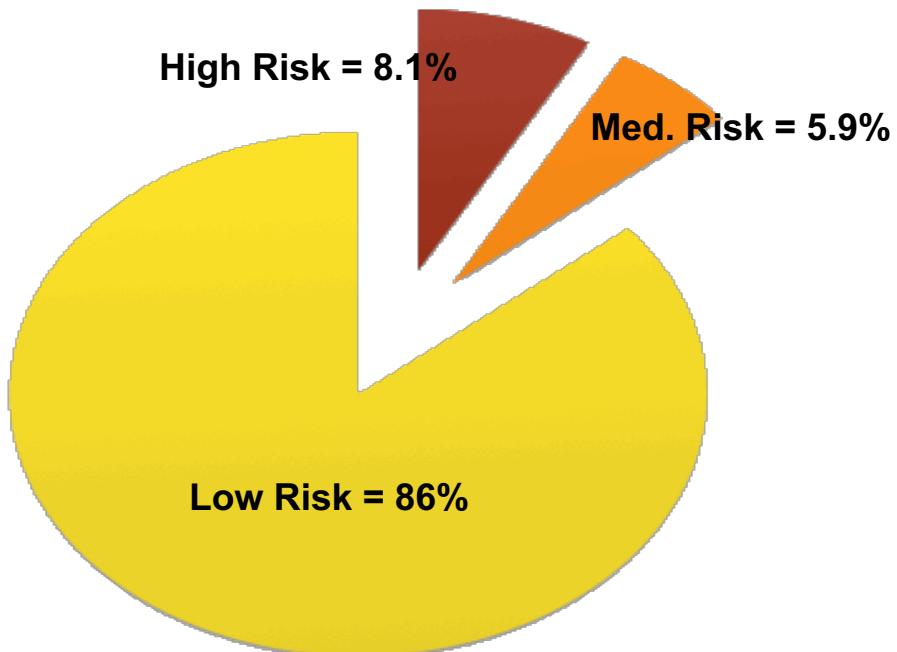
Wave 2 111 completed (>82%)

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

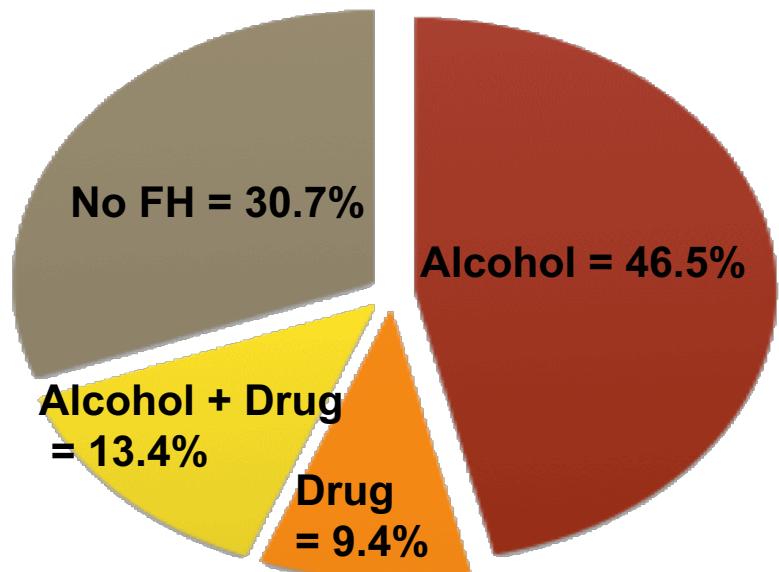
N	135 (73F,62M)
Age	12.7(0.8)
Pubertal status	2.2(0.70)
Race and Ethnicity	
African American	45 (33%)
Caucasian	70 (51.9%)
Hispanic/Latino	9 (6.7%)
Other	11 (8.1%)
Socioeconomic Status	
Parent cumulative years education, mean	16.2(2.9)
Household income	
Mean	\$50,000 -\$74,999
Median	\$100,000-\$149,000
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

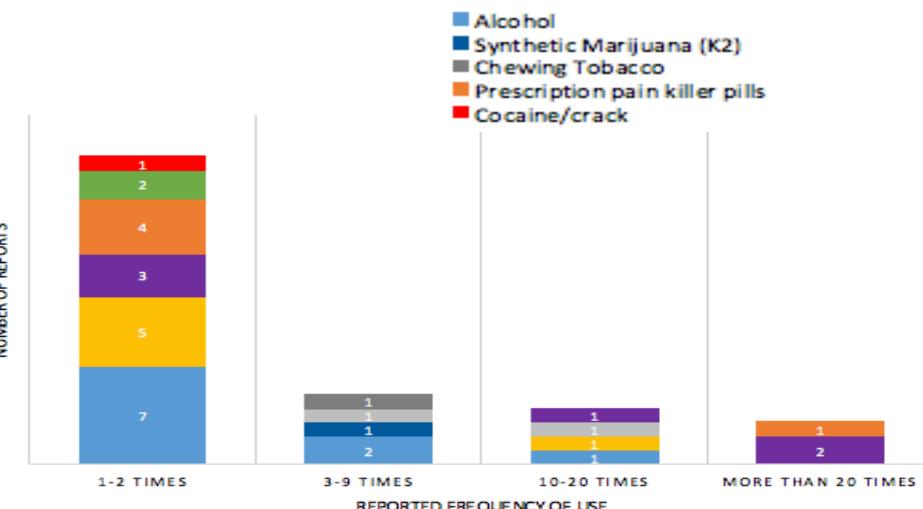
DUSI-QS*



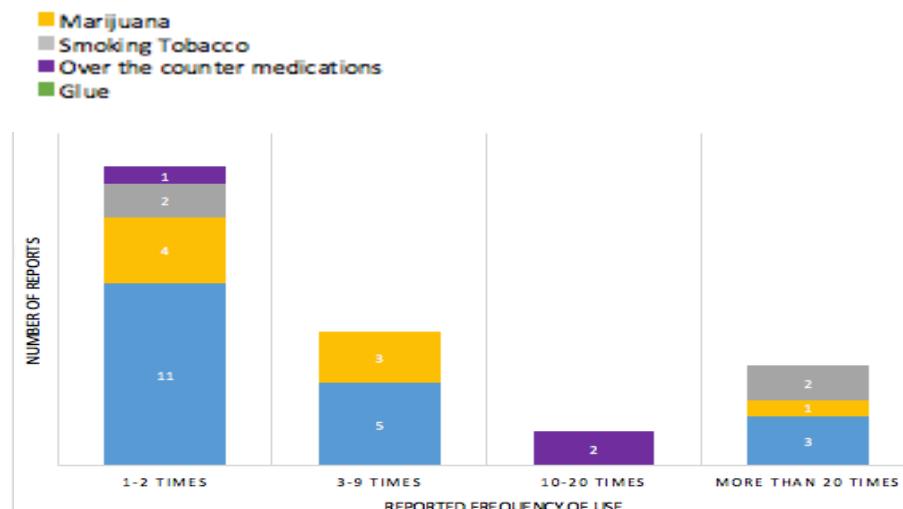
Family History



Frequency of Use by Substance



Wave 2



Wave 3