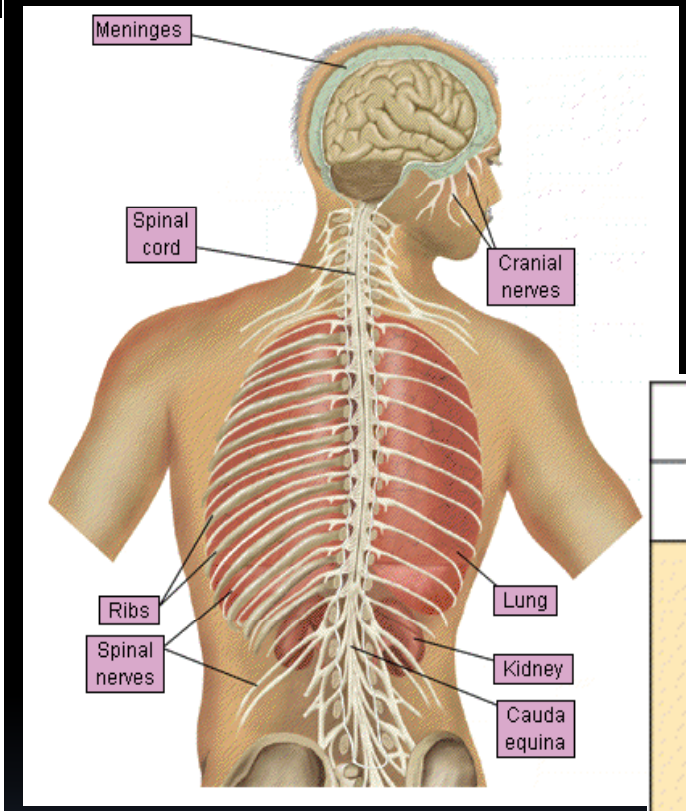
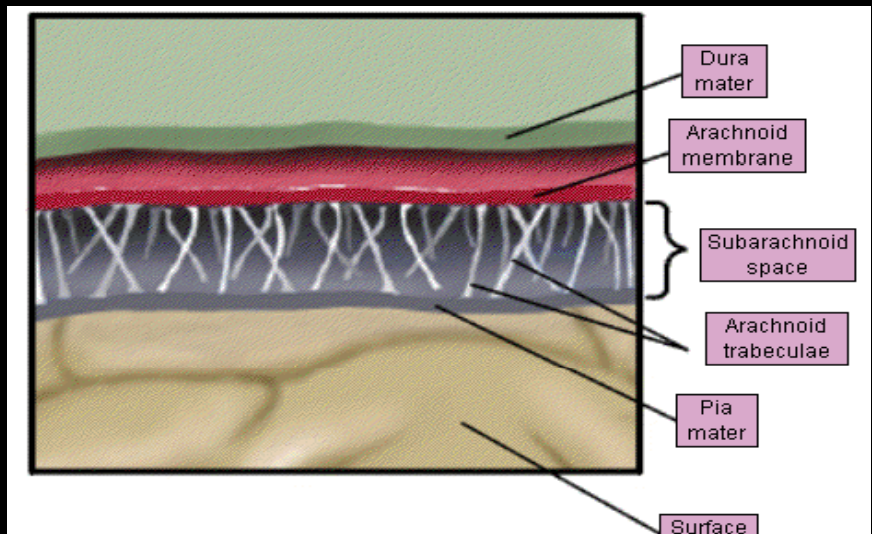
CGSC 6501F: Neuroimaging
Ahmad Sohrabi
Week 3: Neuroanatomy

Institute of Cognitive Science
Carleton University

Inside head



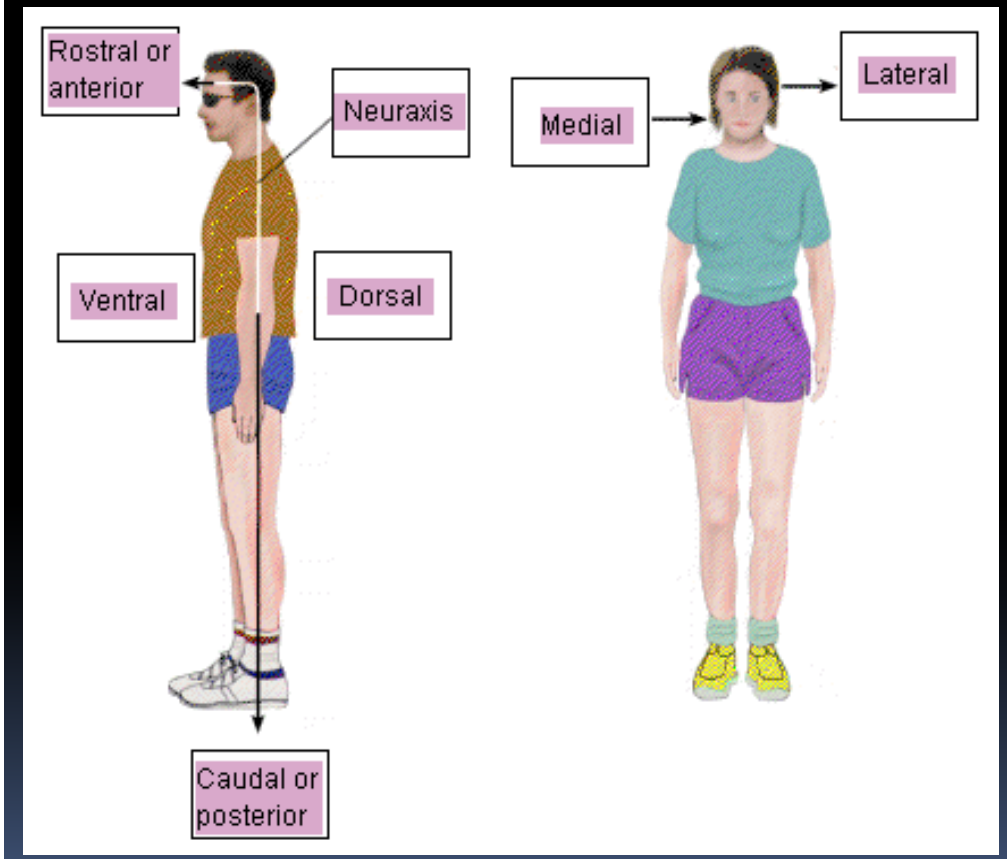


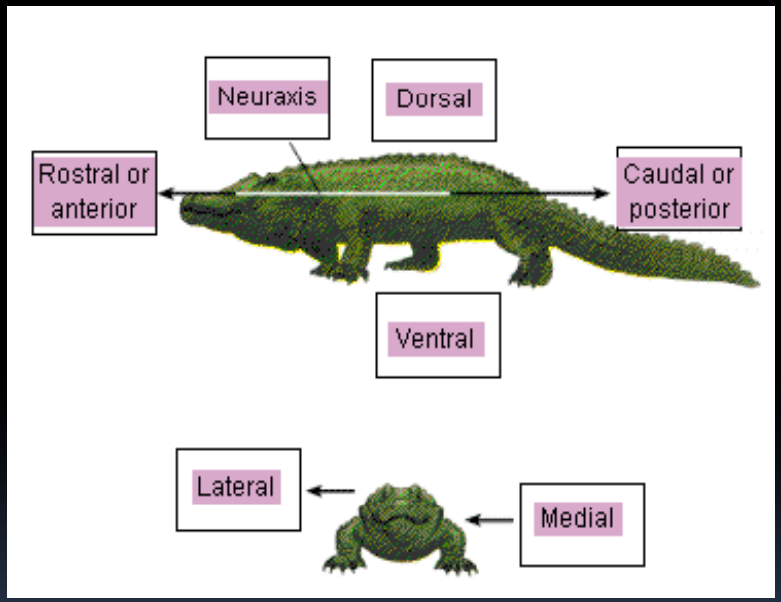
Anatomical Subdivisions of the Brain

Major division	Ventricle	Subdivision	Principal structures
Forebrain	Lateral	Telencephalon	Cerebral cortex Basal ganglia Limbic system
	Third	Diencephalon	Thalamus Hypothalamus
Midbrain	Cerebral aqueduct	Mesencephalon	Tectum Tegmentum
Hindbrain	Fourth	Metencephalon	Cerebellum Pons
		Myelencephalon	Medulla oblongata

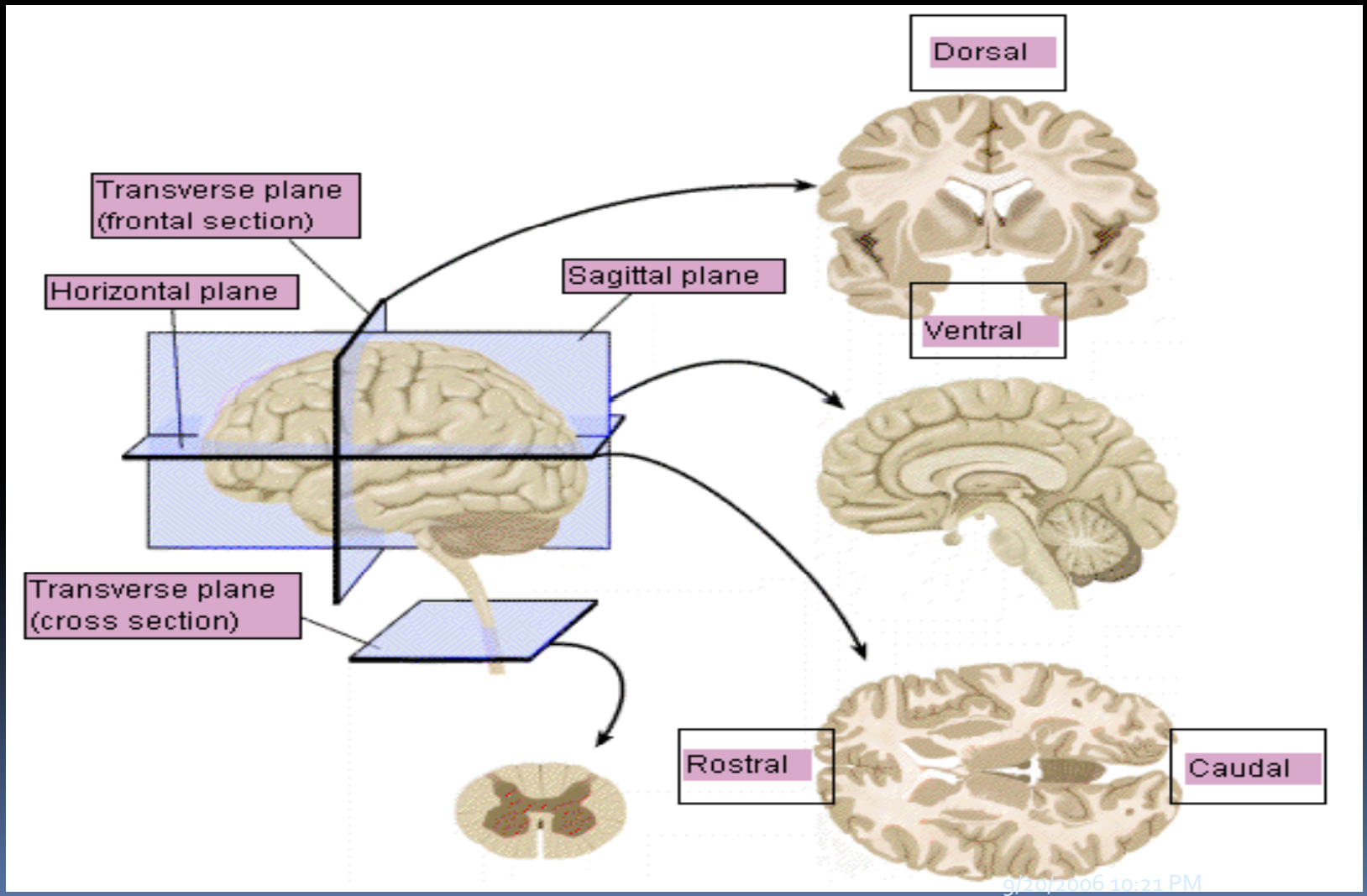
Direction, Sections, and Orientation

Orientation:

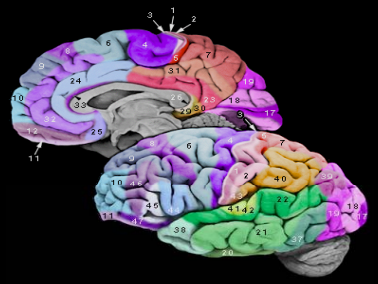




Sections :

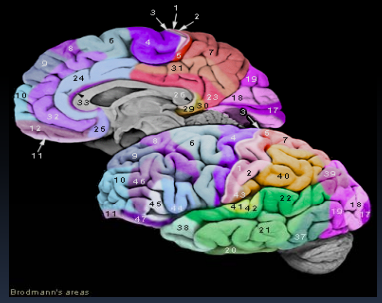

Dorsal
Transverse plane
(frontal section)
Horizontal plane
Sagittal plane
Ventral
Transverse plane
(cross section)
Rostral
Caudal

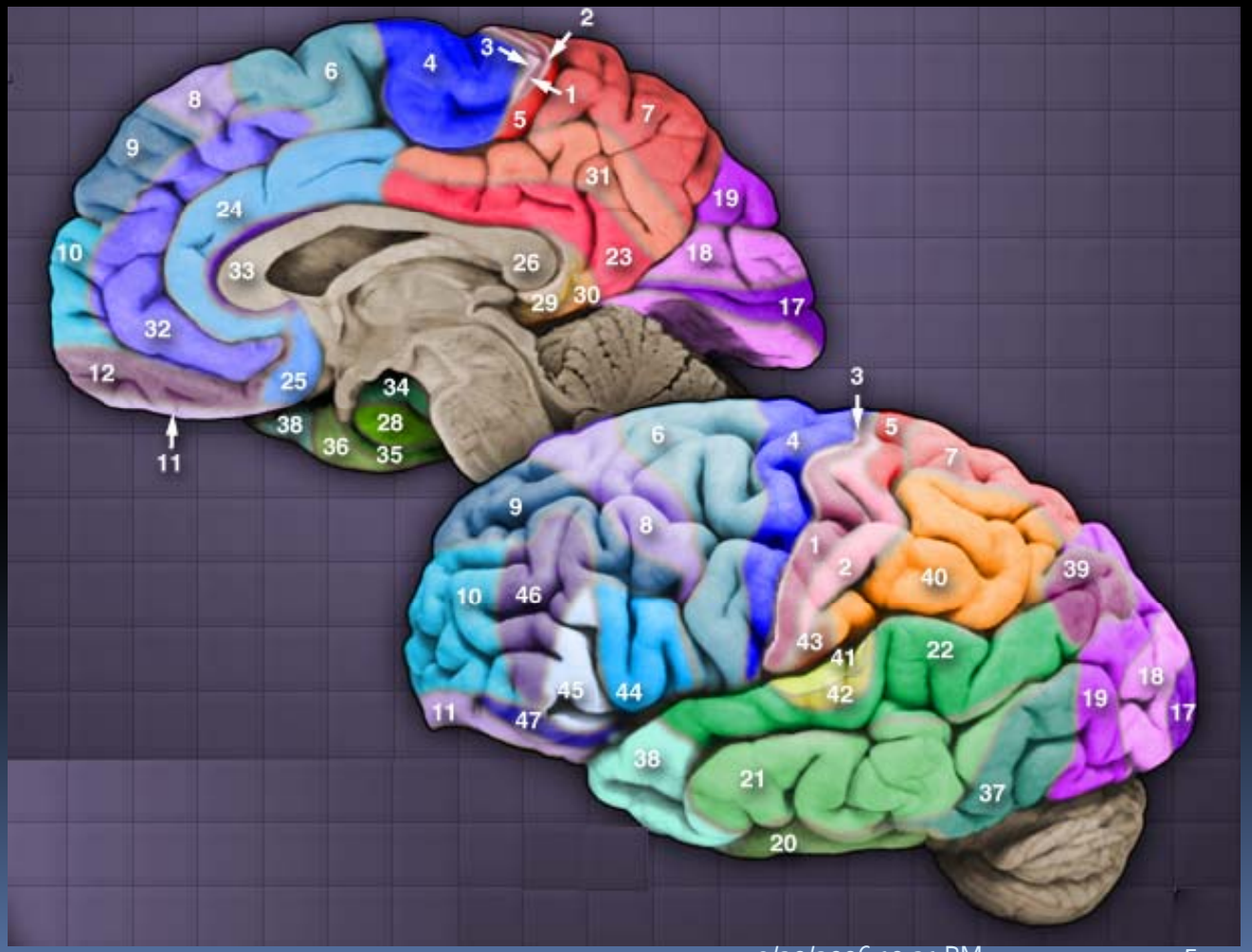
Brodmann's Areas (BAs)



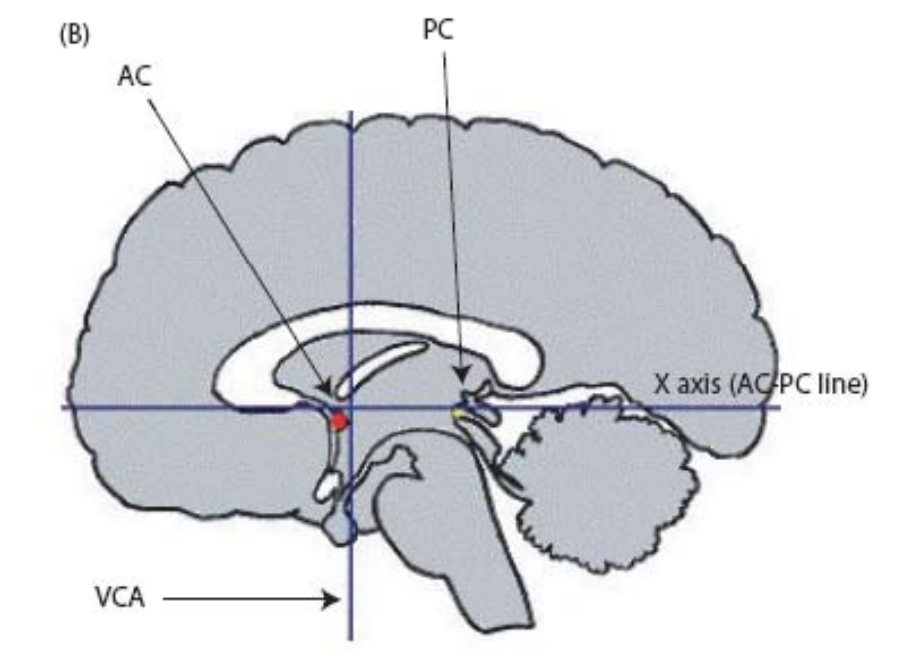
Cytoarchitectonic map

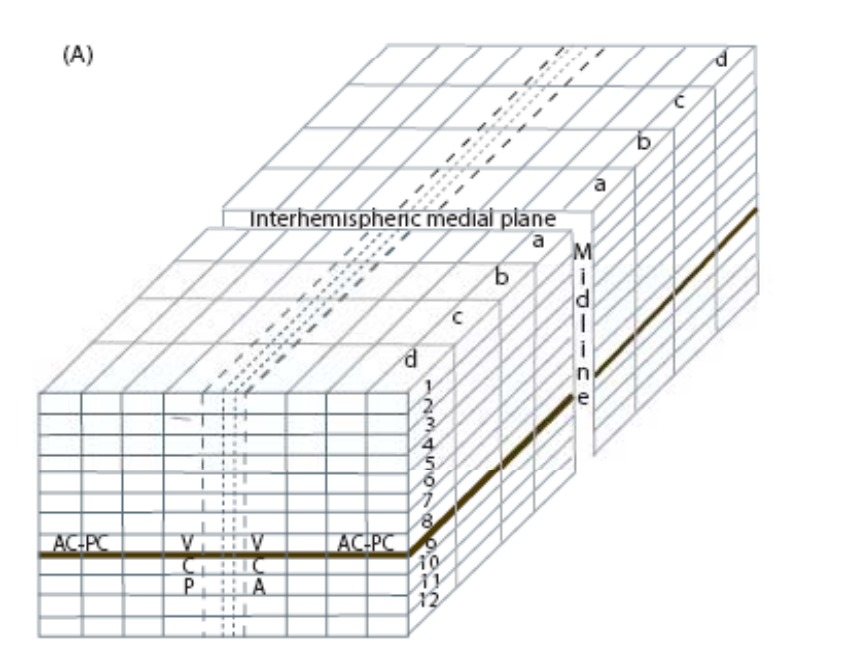
e.g., the cells in Area 17, in the occipital lobe, all receive input from the visual pathway.





Talairach & Tournoux 1988
3D/stereotactic (AC & PC as reference)

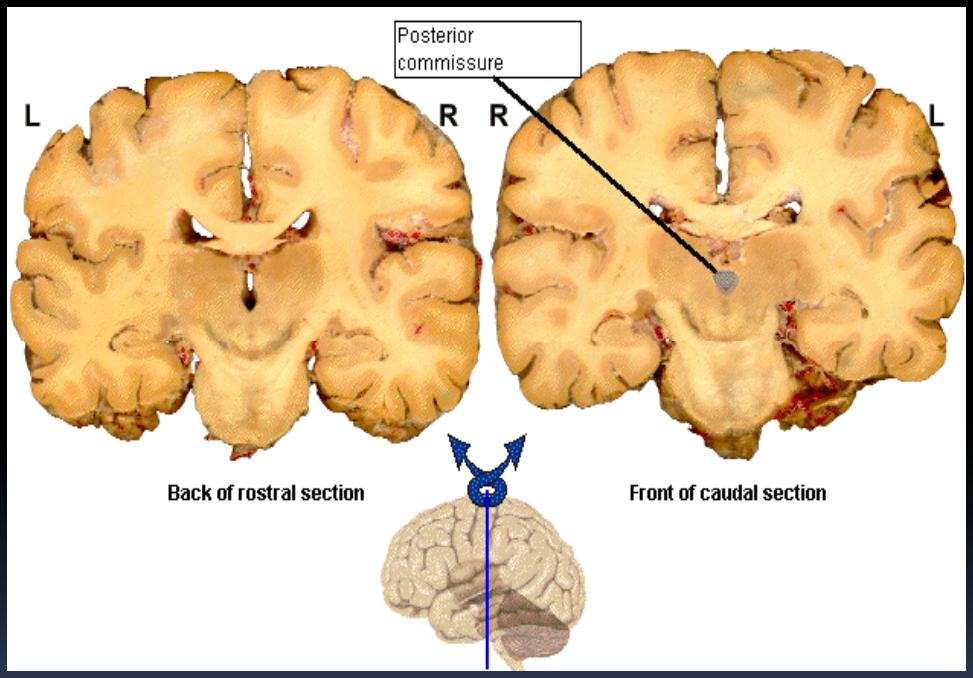




- *AC-PC line (X axis)—A horizontal line running through the anterior* and posterior commissures.
- *VCA line (verticofrontal line, or Y axis)—A vertical line passing* through the anterior commissure
- *Midline (Z axis)—A line forming the interhemispheric sagittal plane*
- AC & PC do not occur in the same axial slice, so reslicing is necessary to put the brain into Talairach space.

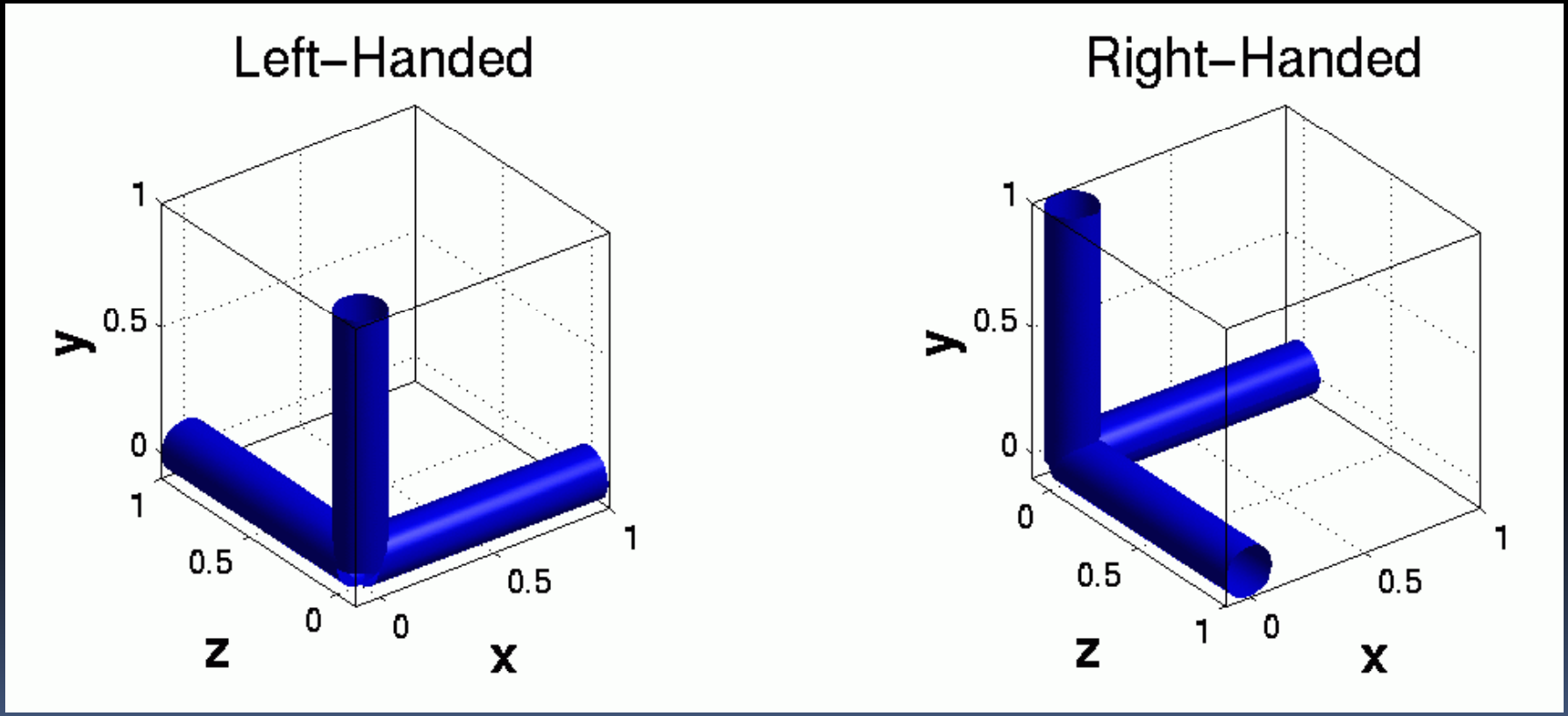
AC & PC


Anterior commissure


Posterior commissure
L
R
R
L
Back of rostral section
Front of caudal section

Orientation

Radiological & Neurological Orientation i.e. LAS & RAS



MNI atlas

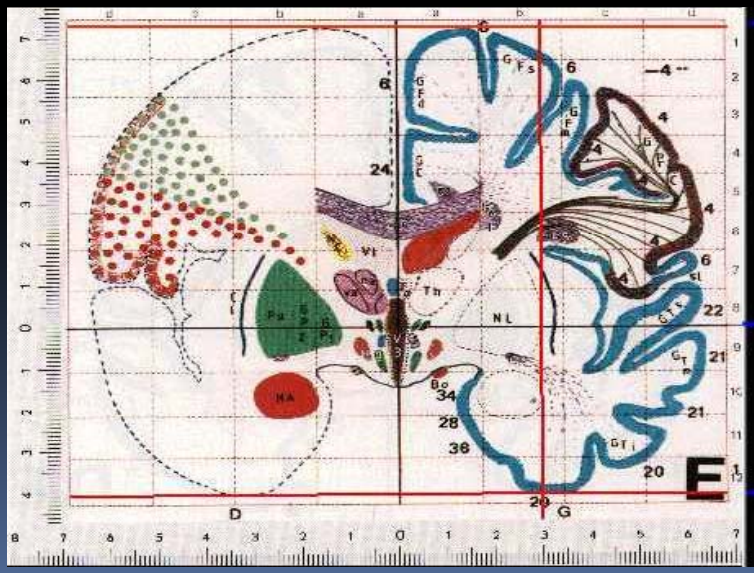
The MNI: more representative of the population.

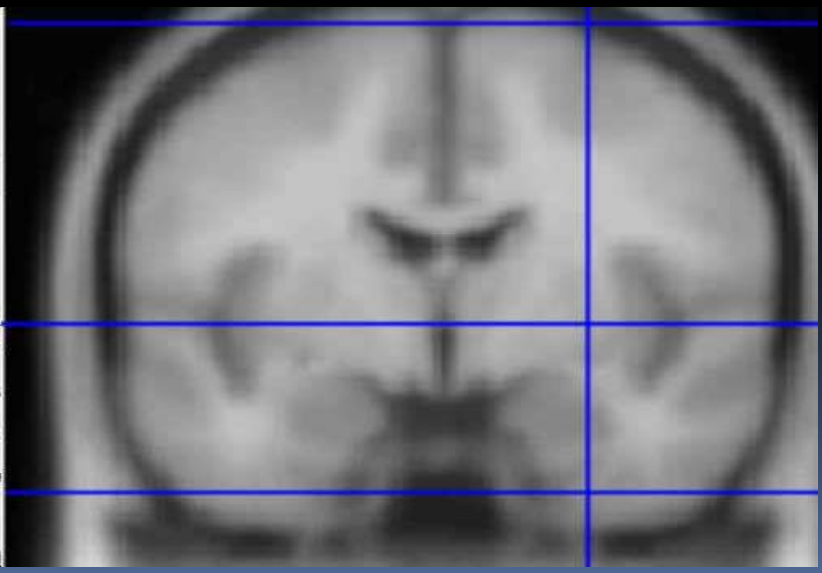
MNI 305

current standard MNI template is the ICBM152

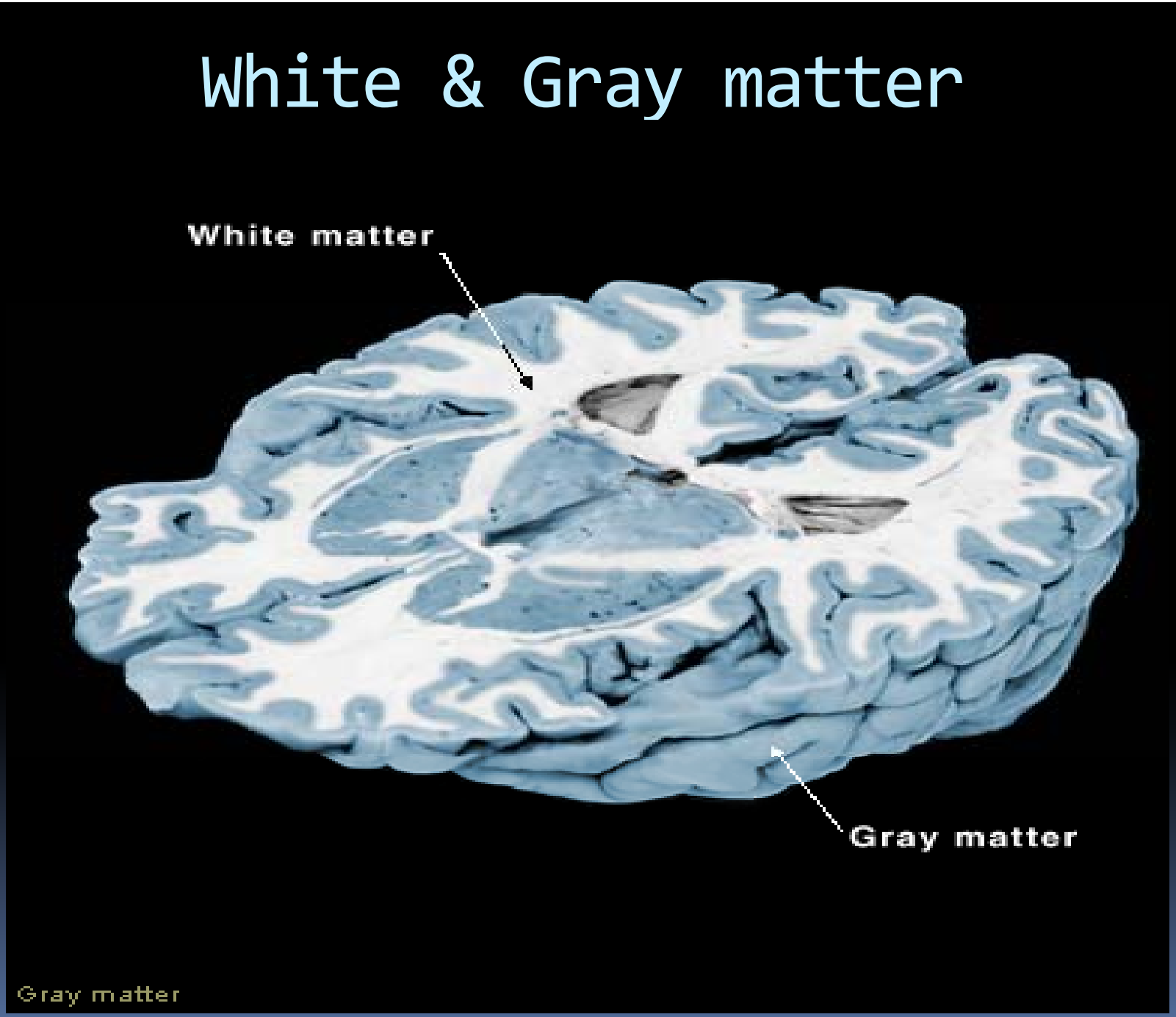
Colin 27

Tal vs. MNI

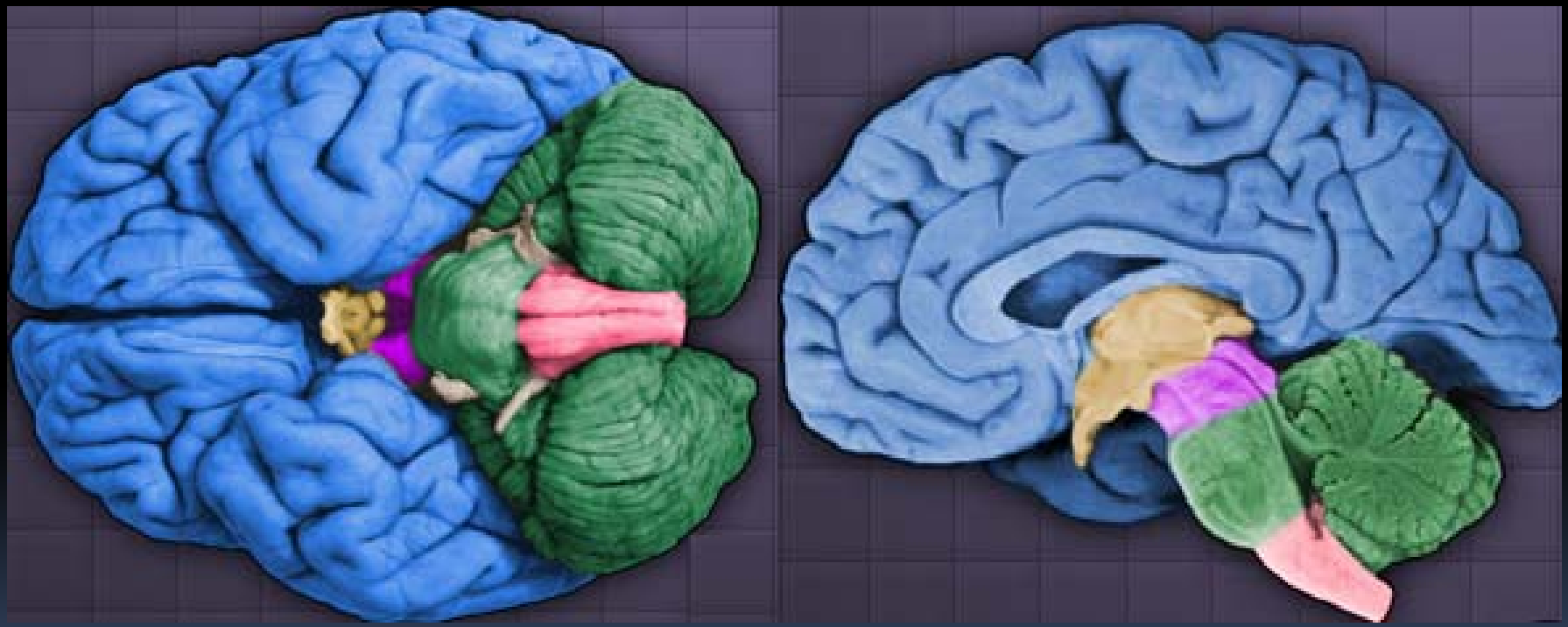




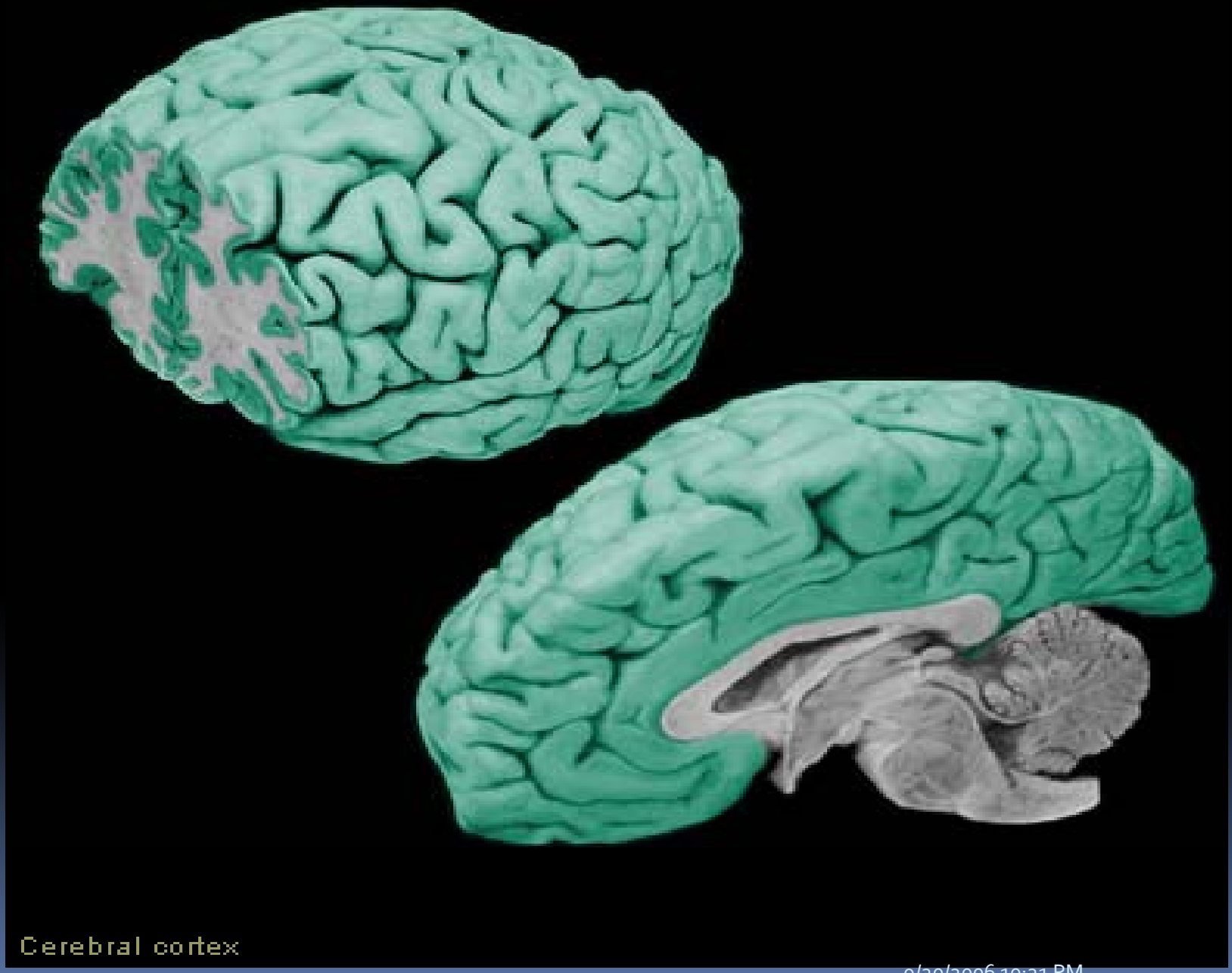
White & Gray matter



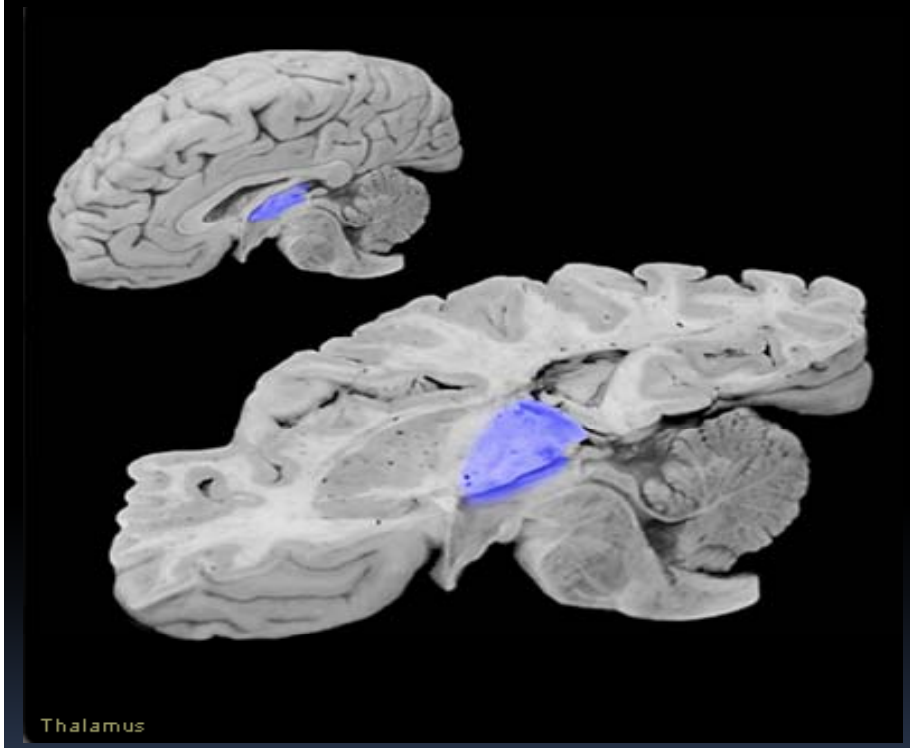
Embrionic divisions

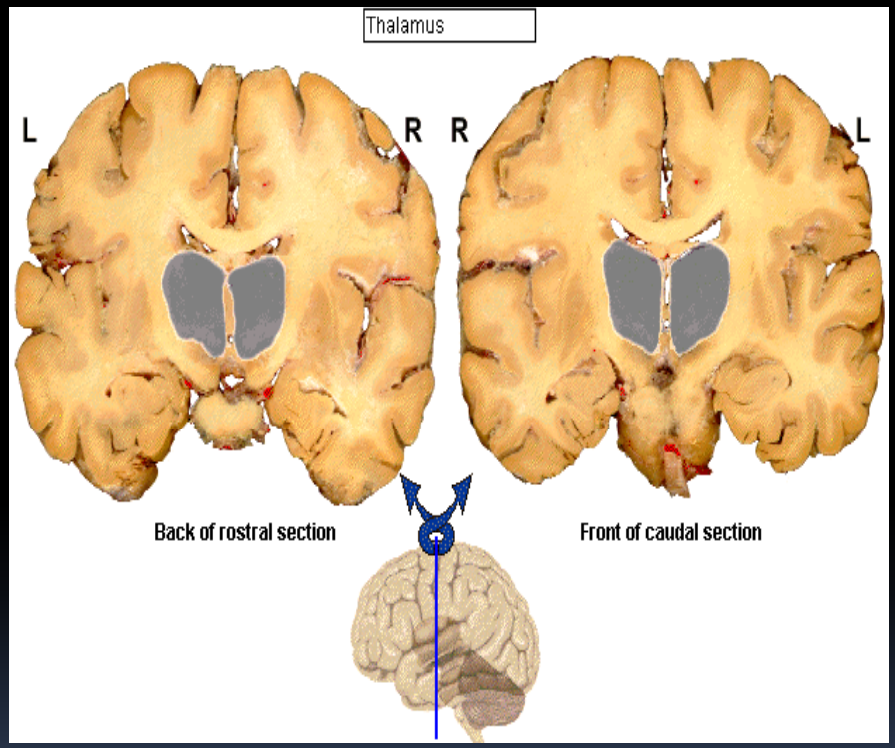


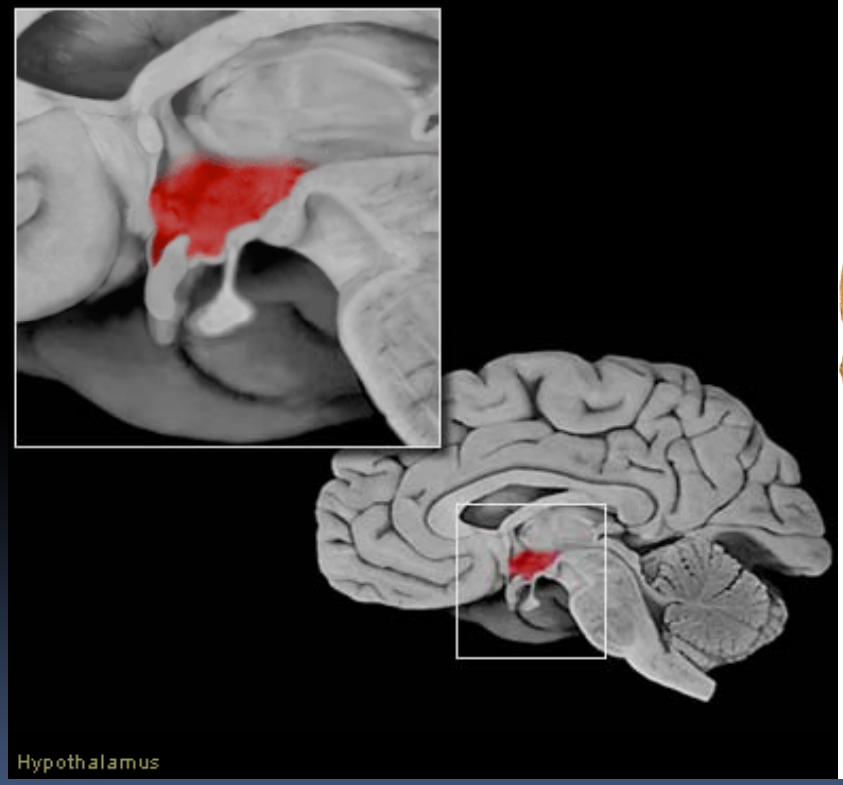

Telencephalon

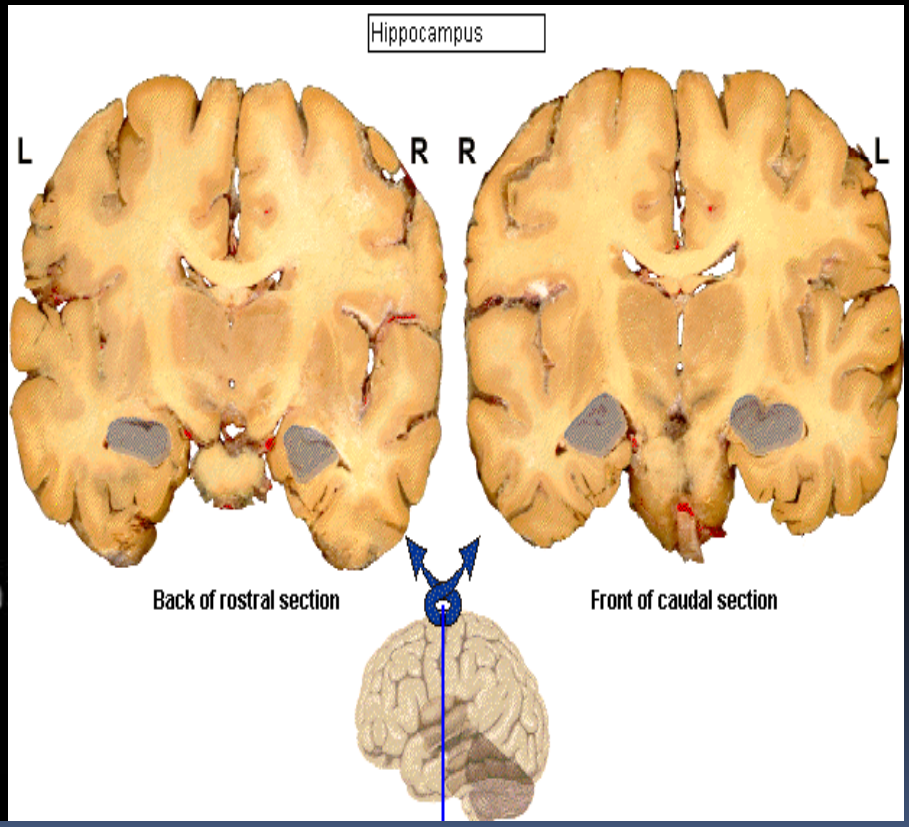

Cerebral cortex


Diencephalon

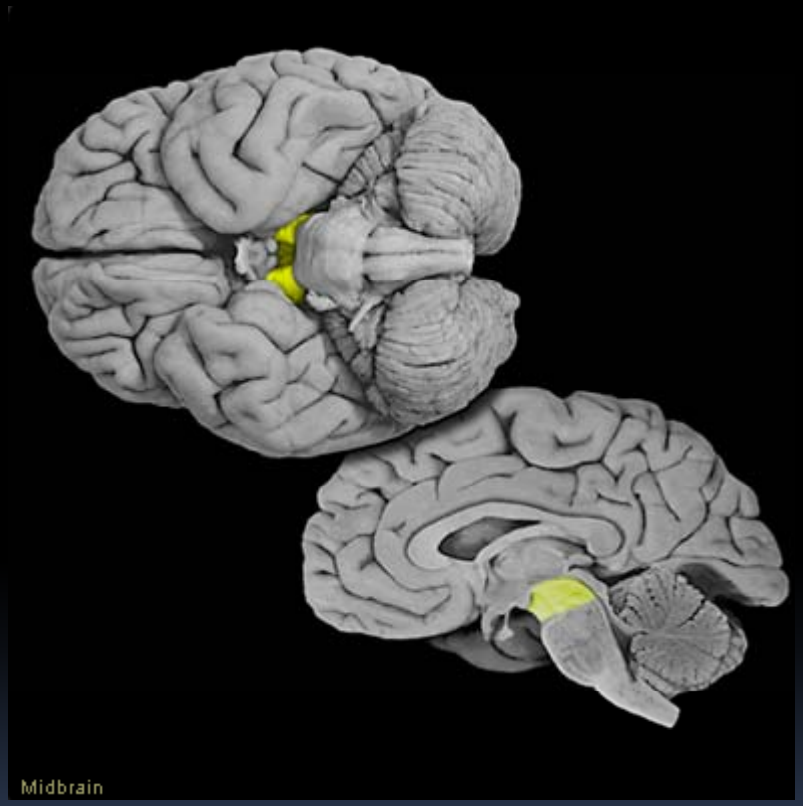

Thalamus


Thalamus
L
R
R
L
Back of rostral section
Front of caudal section

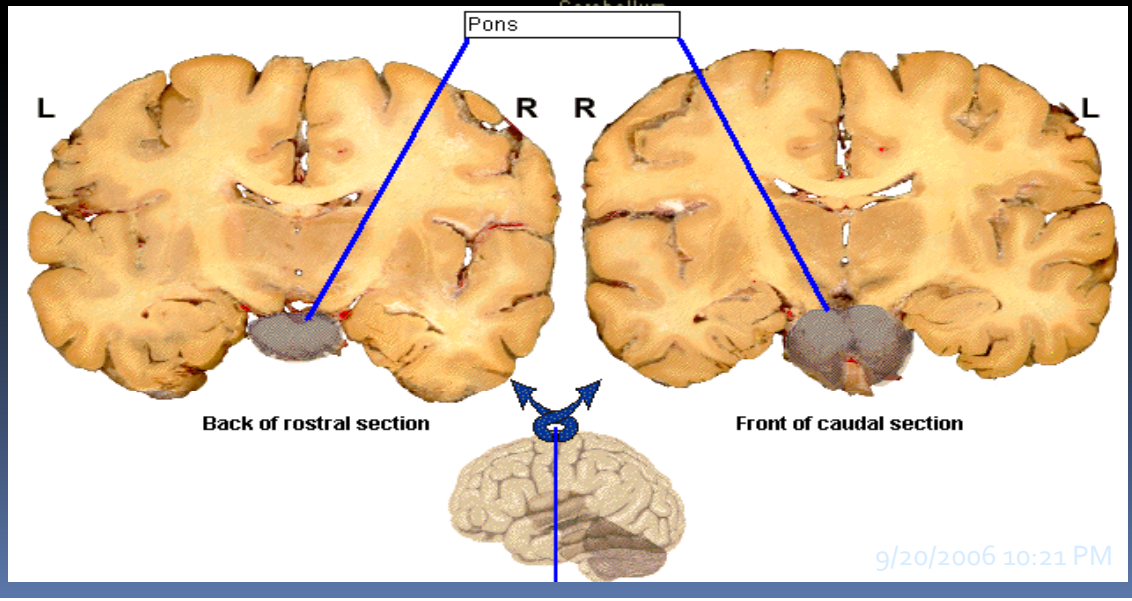

Hypothalamus

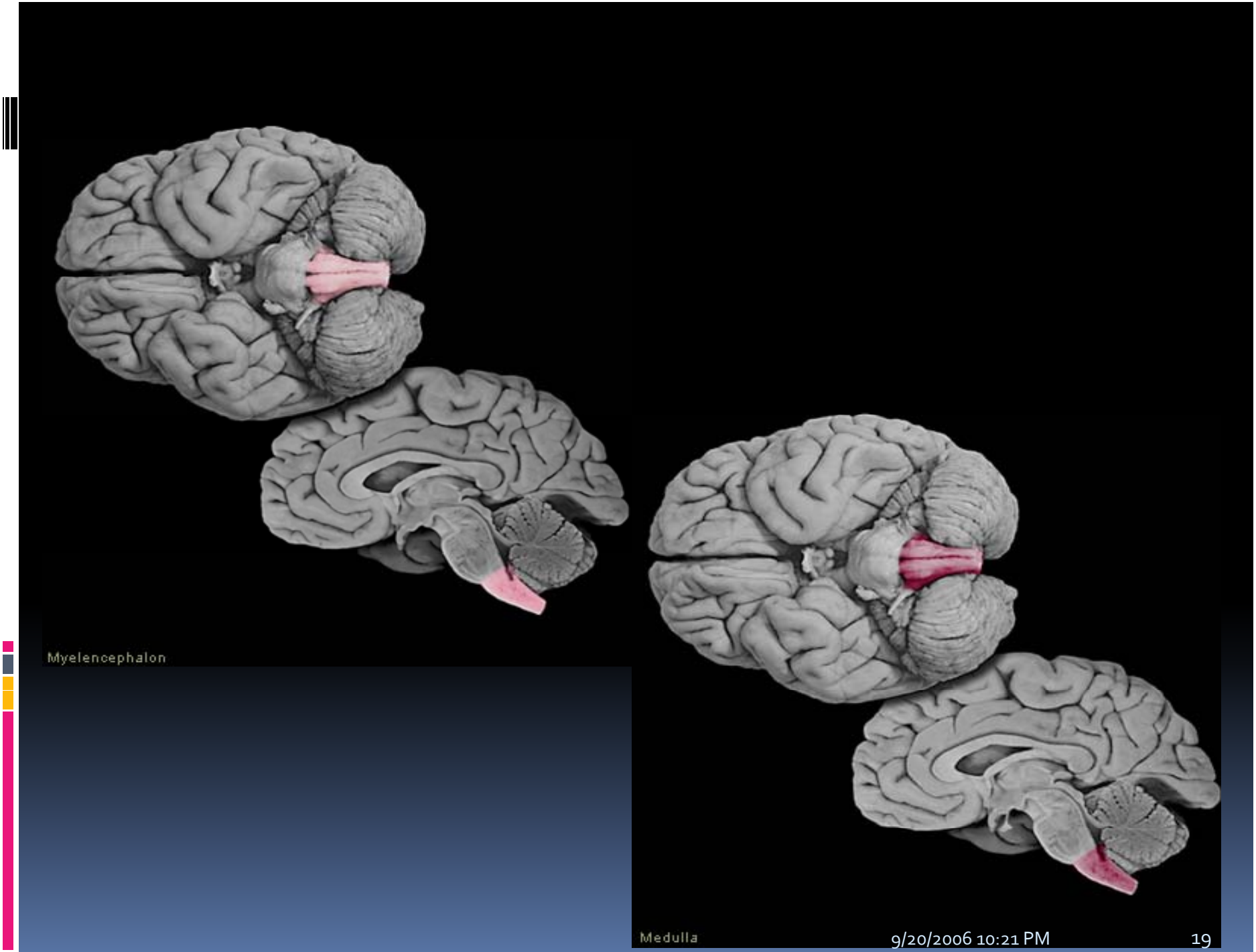

Hippocampus
L
R
R
L
Back of rostral section
Front of caudal section


Mesencephalon

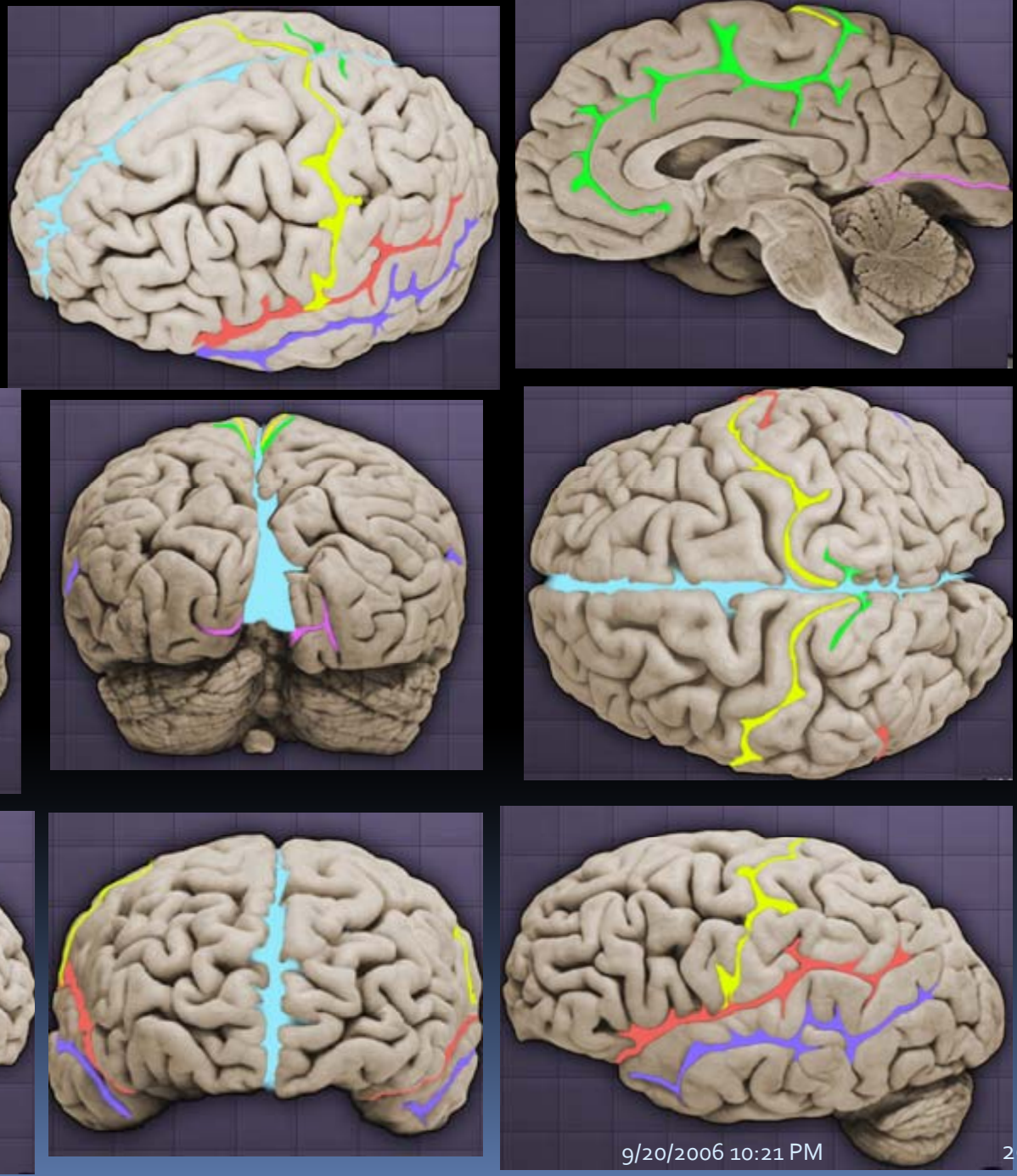

Midbrain

Metencephalon

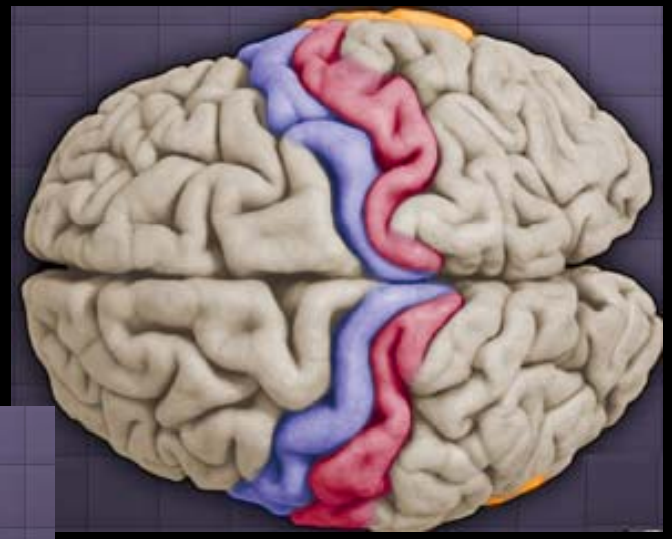



Myelencephalon
Medulla

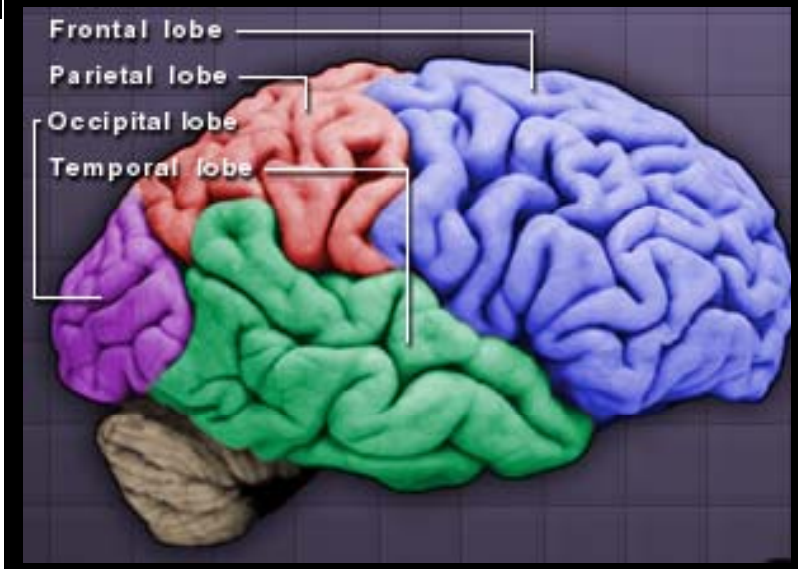
Sulci & fissures

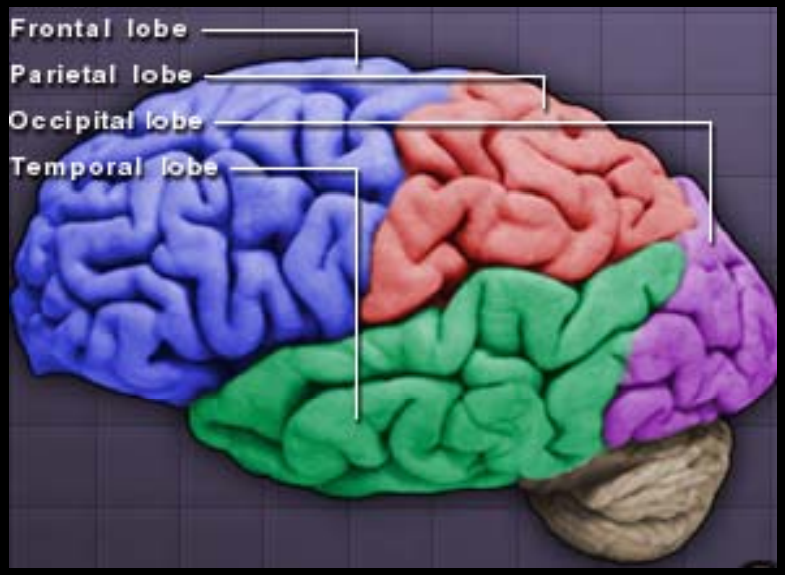


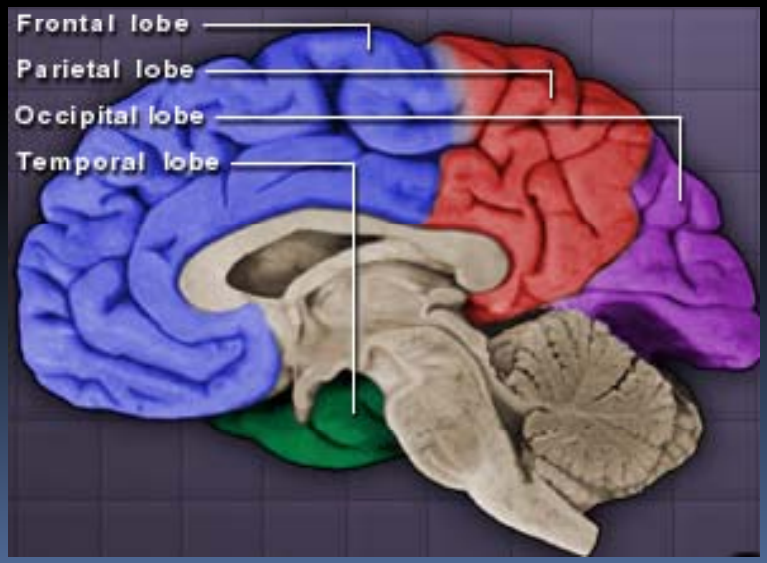
Gyri

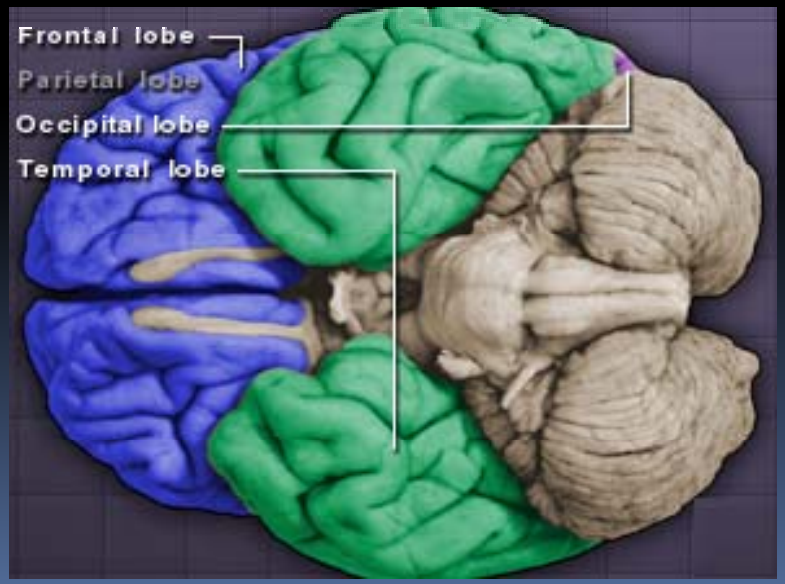


Lobes (Lobule)

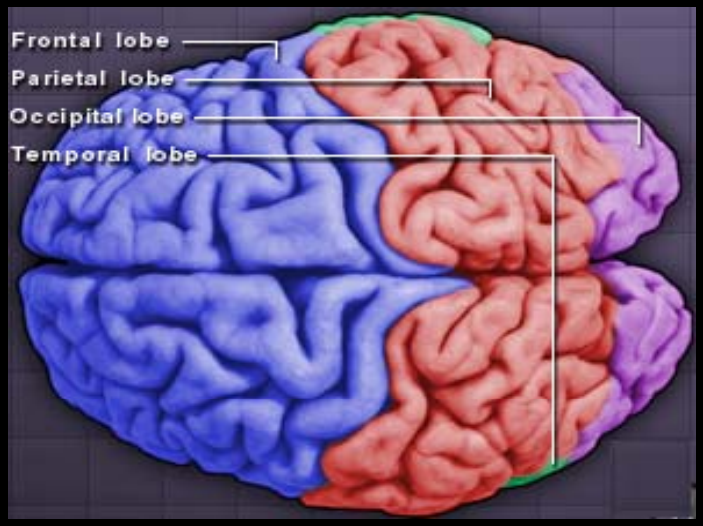


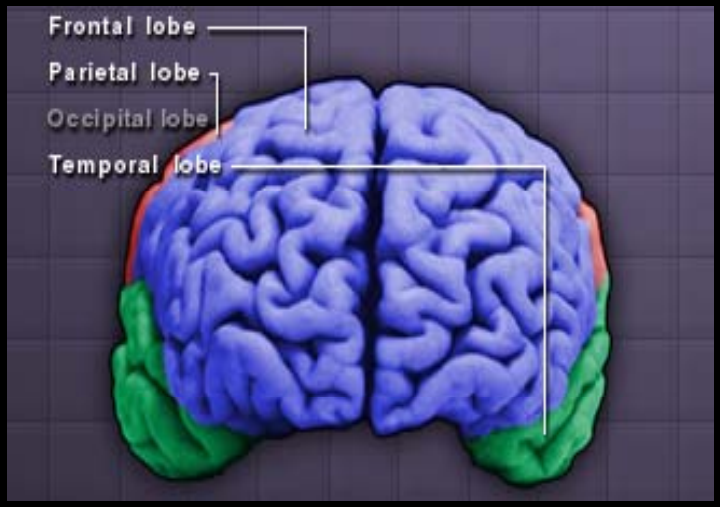


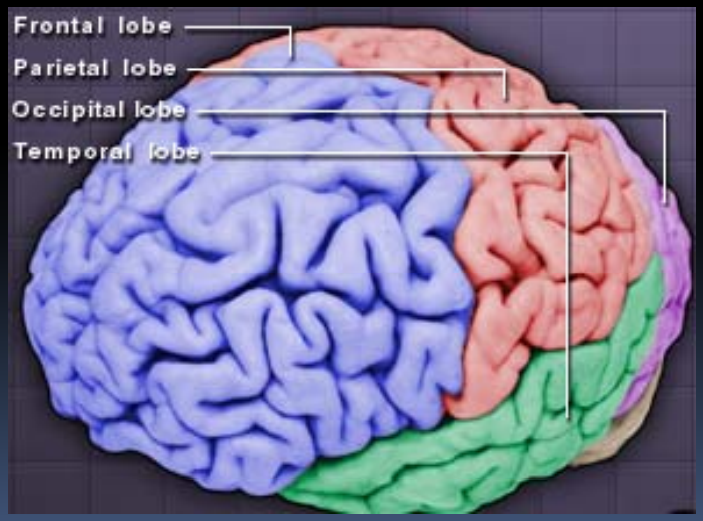


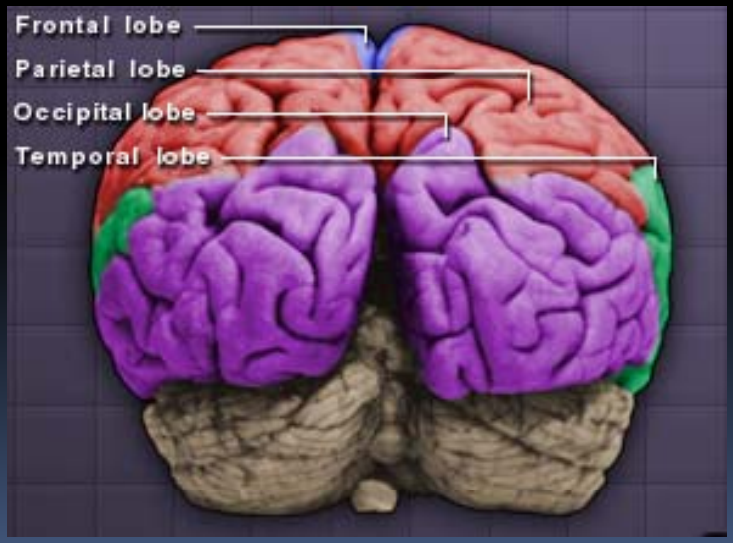


Lobes

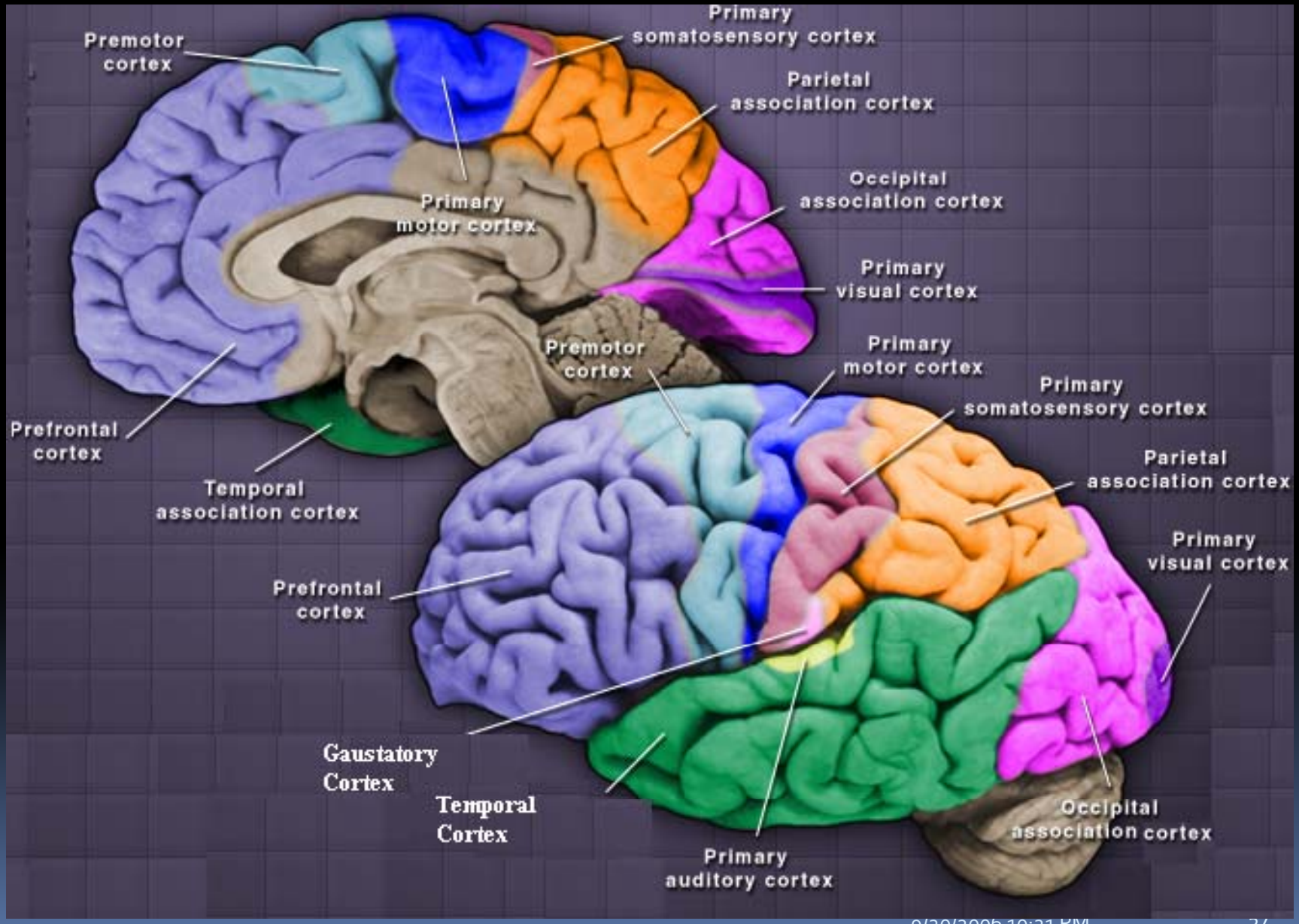

Frontal lobe
Parietal lobe
Occipital lobe
Temporal lobe


Frontal lobe
Parietal lobe
Occipital lobe
Temporal lobe

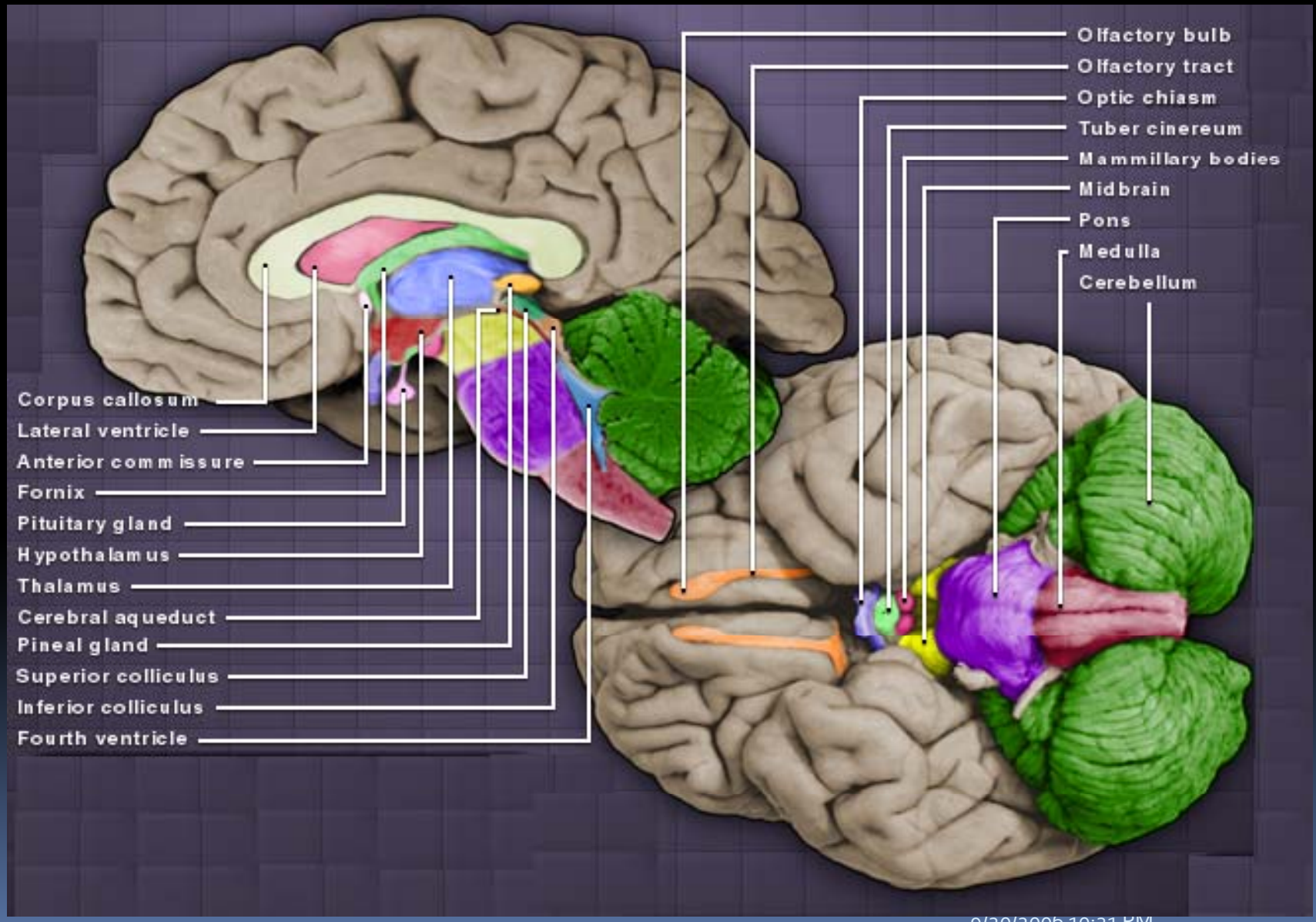

Frontal lobe
Parietal lobe
Occipital lobe
Temporal lobe


Frontal lobe
Parietal lobe
Occipital lobe
Temporal lobe

Areas


Premotor cortex
Primary somatosensory cortex
Parietal association cortex
Occipital association cortex
Primary motor cortex
Primary visual cortex
Premotor cortex
Primary motor cortex
Primary somatosensory cortex
Parietal association cortex
Primary visual cortex
Prefrontal cortex
Temporal association cortex
Prefrontal cortex
Gaustatory Cortex
Temporal Cortex
Primary auditory cortex
Occipital association cortex

Areas:


Olfactory bulb
Olfactory tract
Optic chiasm
Tuber cinereum
Mammillary bodies
Midbrain
Pons
Medulla
Cerebellum
Corpus callosum
Lateral ventricle
Anterior commissure
Fornix
Pituitary gland
Hypothalamus
Thalamus
Cerebral aqueduct
Pineal gland
Superior colliculus
Inferior colliculus
Fourth ventricle

References:

- http://www.med.harvard.edu/AANLIB/home.html
  http://www.med.wayne.edu/diagRadiology/Anatomy_Modules/brain/brain.html
  http://www9.biostr.washington.edu/da.html
  http://www.msu.edu/~brains/humanatlas/
  http://www.brainexplorer.org/brain_atlas/Brainatlas_index.shtml

- MNI and Talairach spaces:
  Link:
  http://imaging.mrc-cbu.cam.ac.uk/imaging/MniTalairach#head-4d6d72f2ac...

- MRI orientation:
  http://eeg.sourceforge.net/mri_orientation_notes.html

- Sylvious 2 software, Wiliams S. M.
- Neuroscience Animation Carleson N R.