

# Neuroanatomy: normal MRI brain correlates

- Remco Santegoeds MD PhD
- Dept. Radiology MUMC

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  - Grey and white matter
  - Ventricular system
  - Brain stem and cranial nerves
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## Imaging technique

- CT
- MRI

*Statement: MRI is better than CT.*

Who agrees?

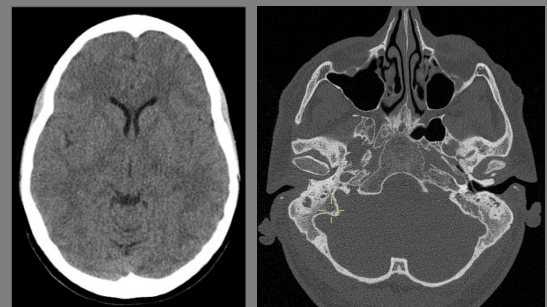
## CT

- X-ray technique
- Fast
- Cross-sectional imaging

## CT

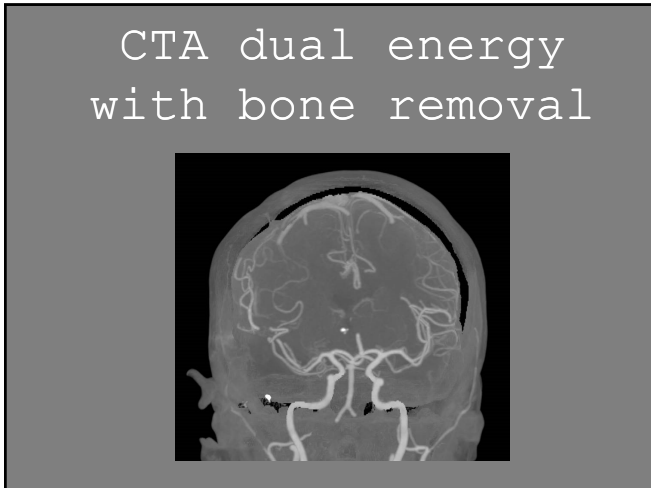
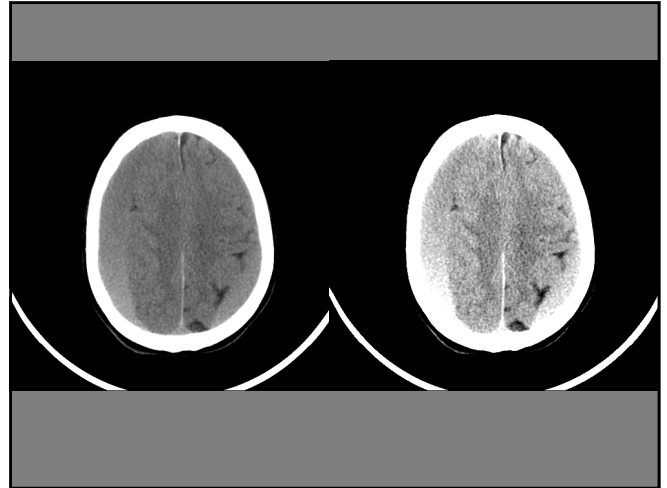
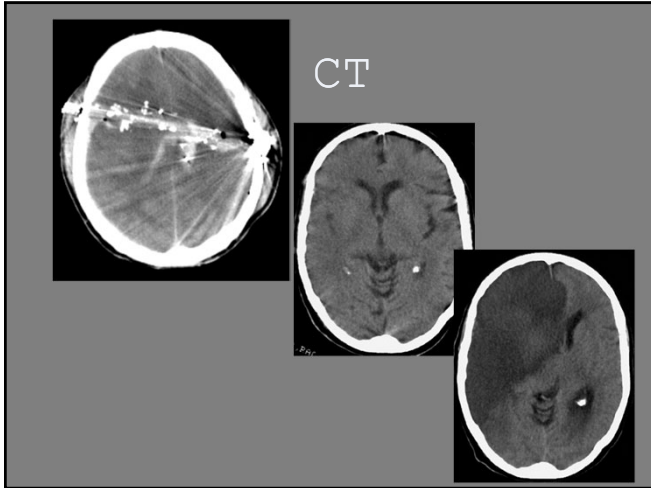


## CT



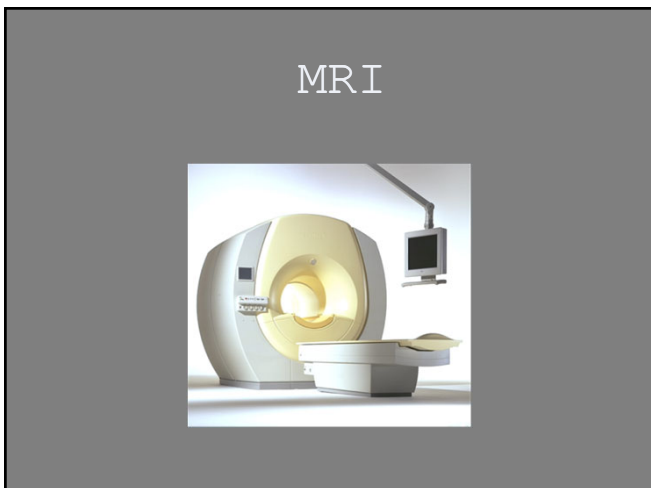
Soft filter

Hard filter

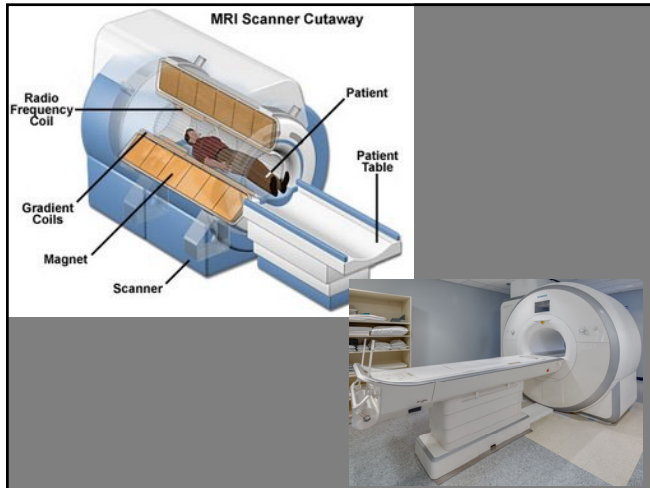


Conclusion

*Always keep in mind the clinical applicability of research*

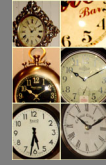


- MRI
- No X-ray
  - Technique is based on magnetic properties of water protons
  - Slower than CT
  - Excellent soft-tissue contrast
  - Functional imaging



Signal intensity depends  
on

- T1
- T2
- proton density



Water

- on T1W: dark
- on PDW: grey
- on T2W: bright

Majority of diseases

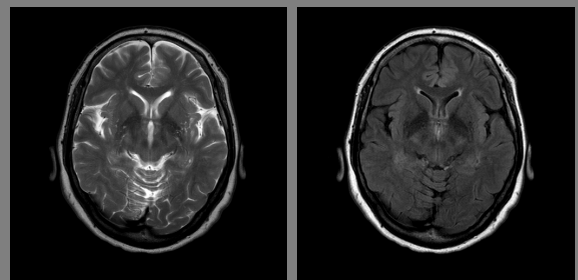
- on T2W: bright
- on T1W: dark or not visible
- on PD: bright or grey



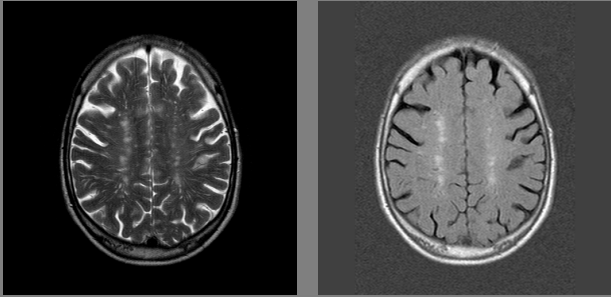
Brain MRI imaging  
basic sequences

- T2
- FLAIR
- DWI
- T1 (+/- contrast)
- T2\* / SWI

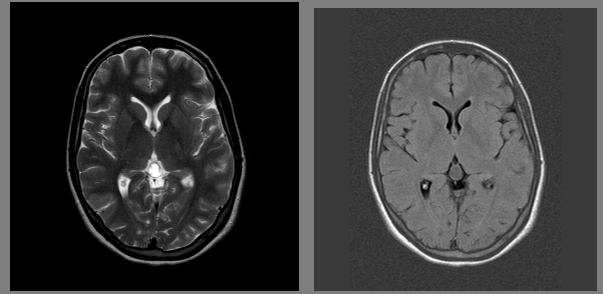
FLAIR:  
*water/CSF or not CSF?*



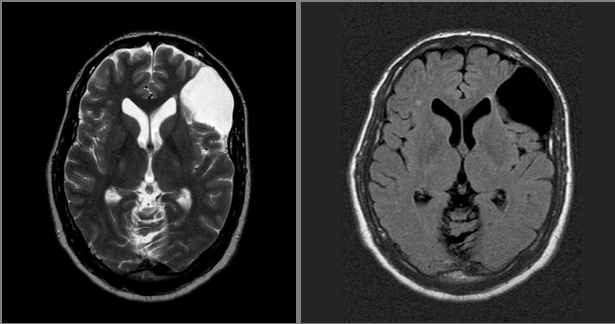
FLAIR:  
*water/CSF or not CSF?*



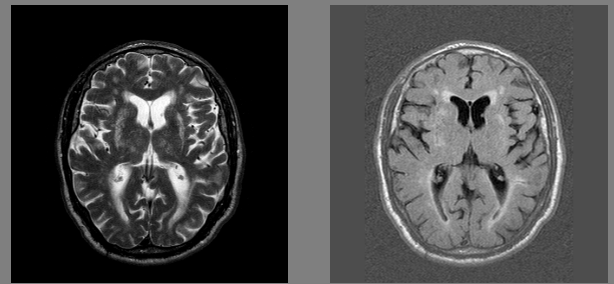
FLAIR:  
*water/CSF or not CSF?*



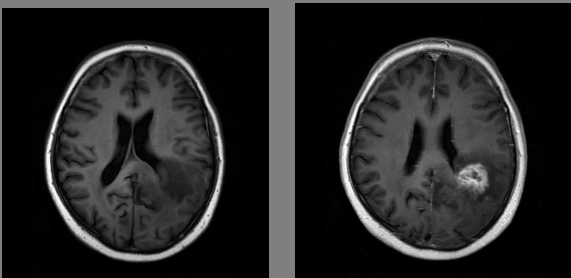
FLAIR:  
*water/CSF or not CSF?*



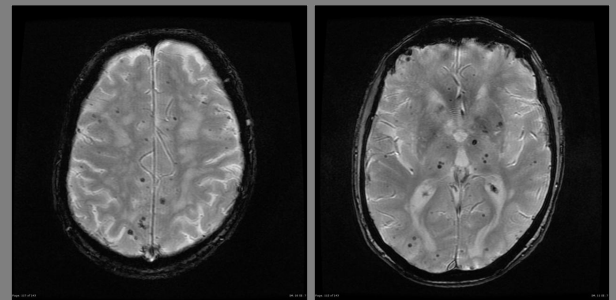
FLAIR cannot be used for posterior  
fossa and thalamus!!



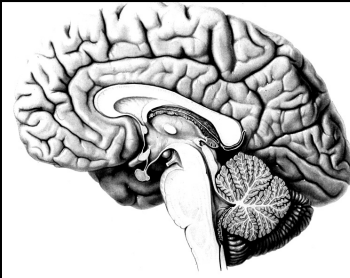
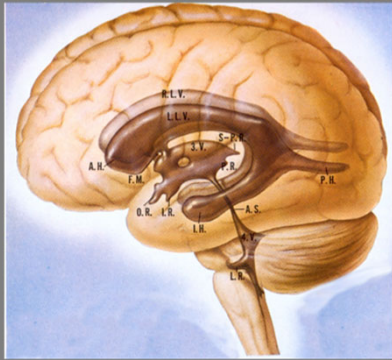
T1 with contrast



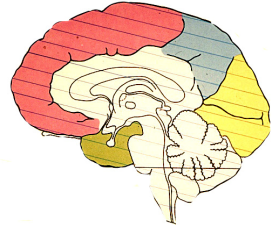
Gradient echo / T2\*  
(Microbleeds)



# Anatomy

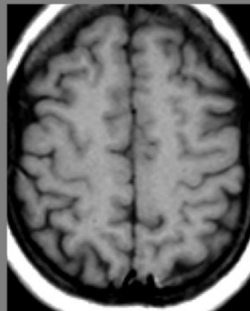


lobus frontalis  
lobus parietalis  
lobus occipitalis  
lobus temporalis  
brainstem  
corpus callosum  
cerebellum

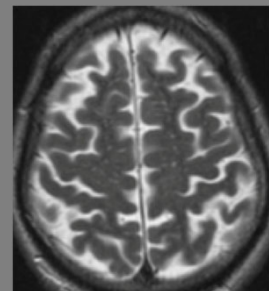
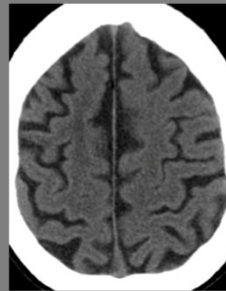


## Central sulcus

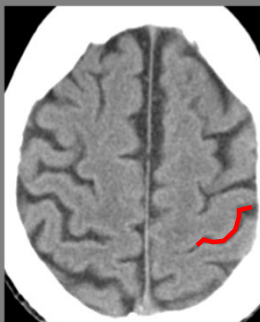
- Bracket sign  
ramus marginalis of cingulate
- Sigmoid hook sign
- Pre-frontal sulcus:  
The posterior end of the superior frontal sulcus joins the precentral sulcus in 85%
- Postcentral gyrus thinner than precentral gyrus



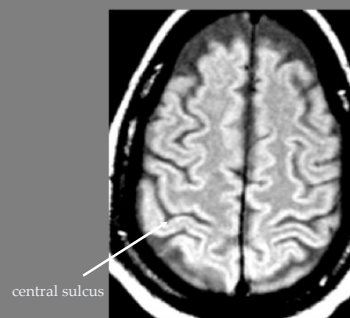
## Central sulcus



## Central sulcus



## Central sulcus



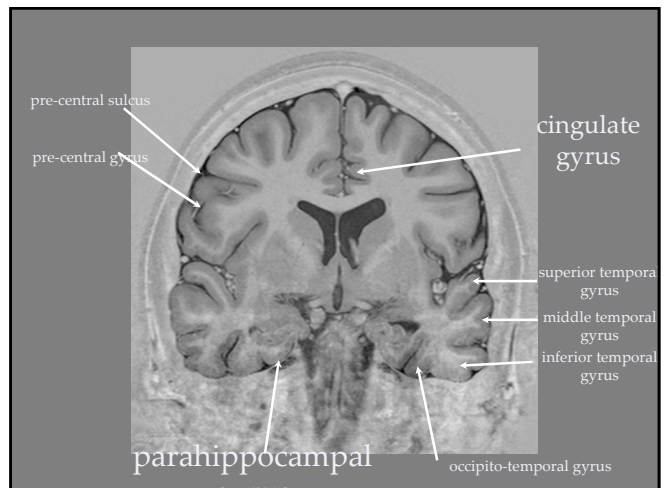
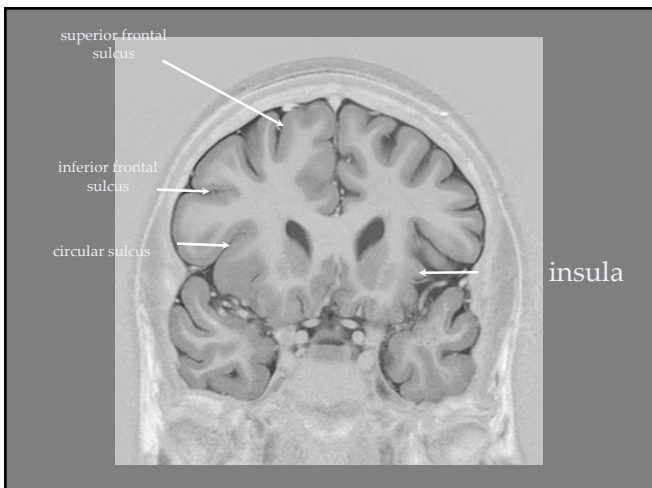
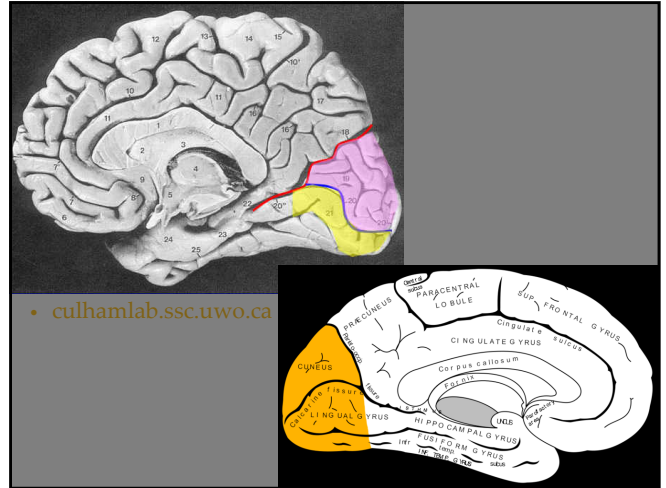


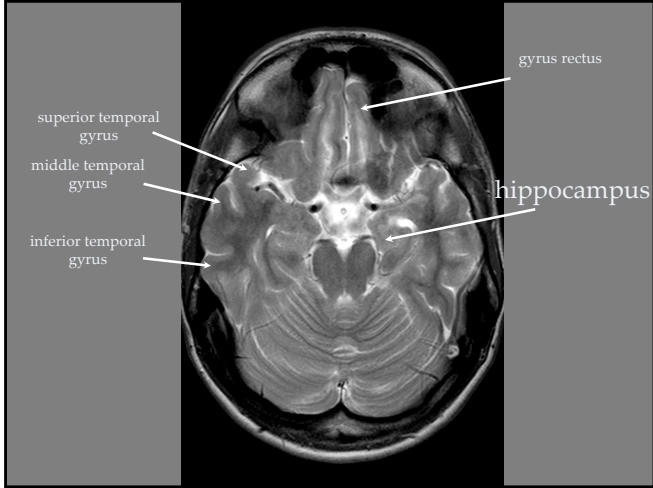
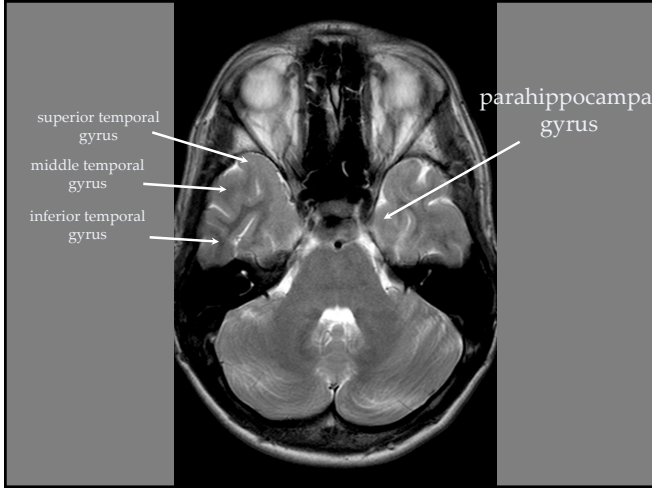
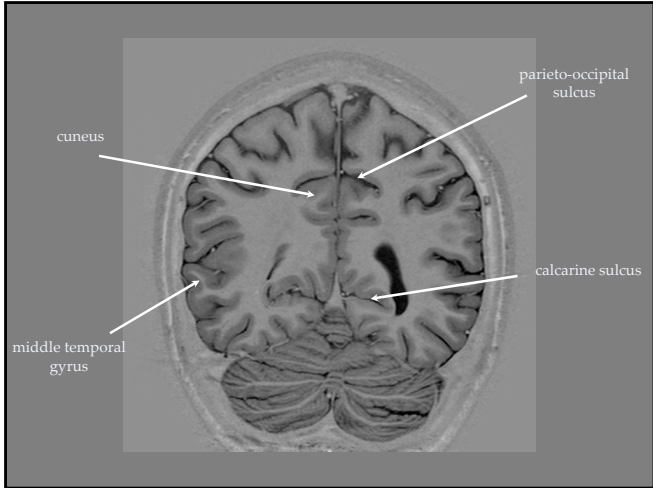
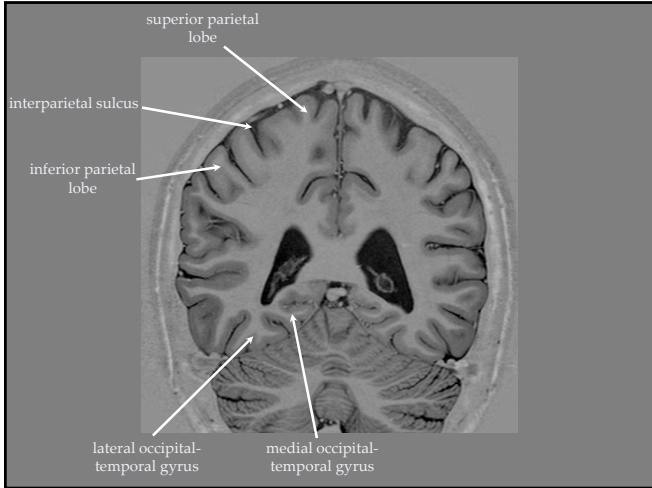
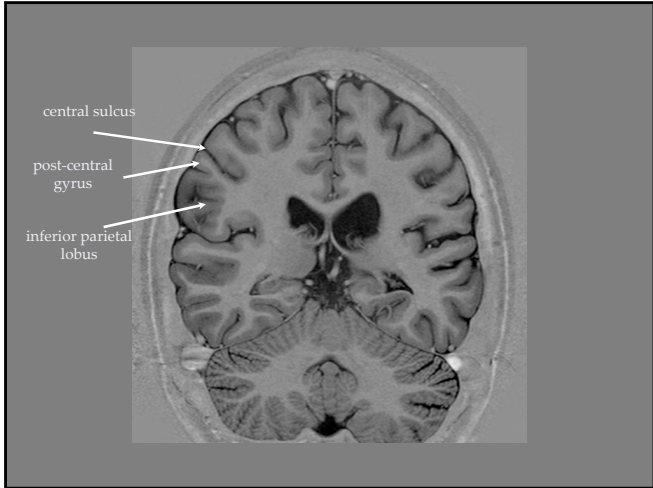
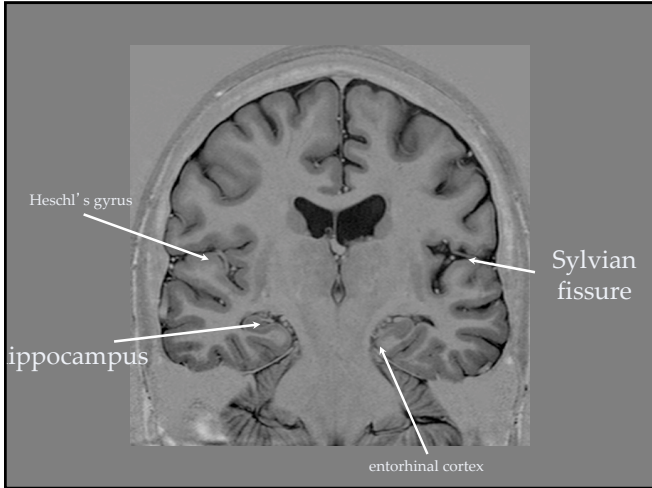
# Occipital lobe

Apex: calcarine sulcus

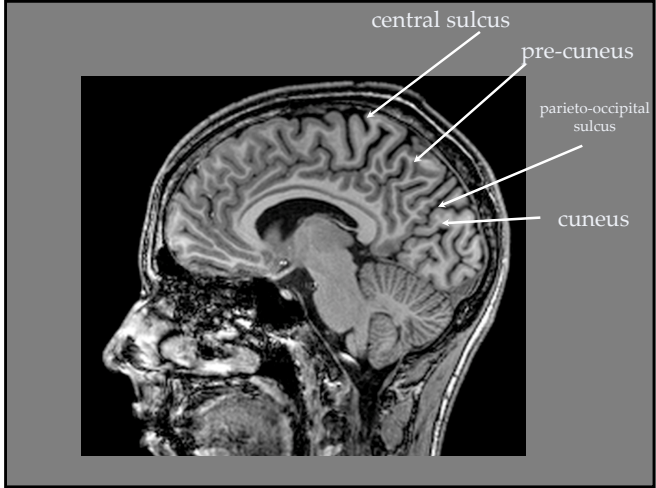
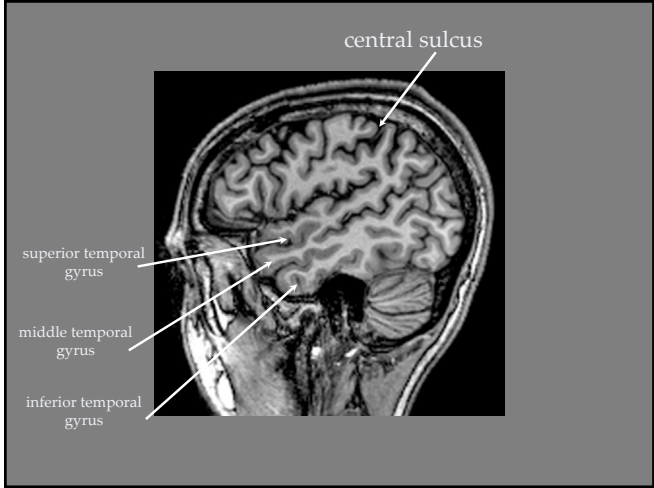
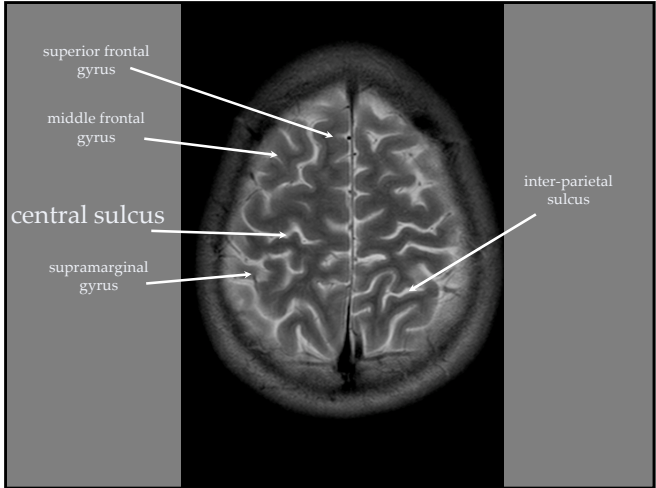
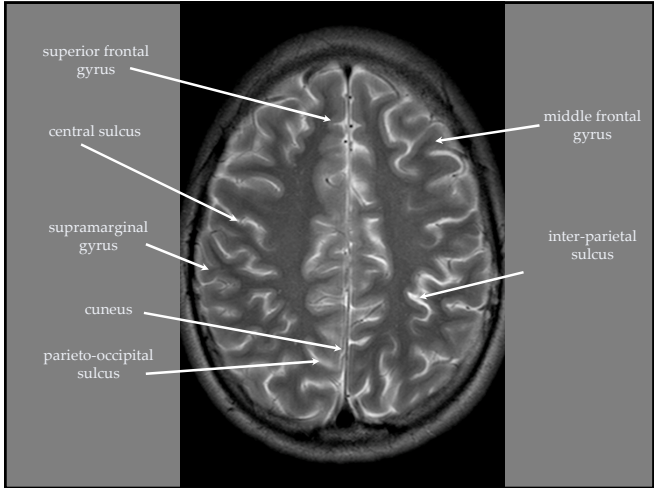
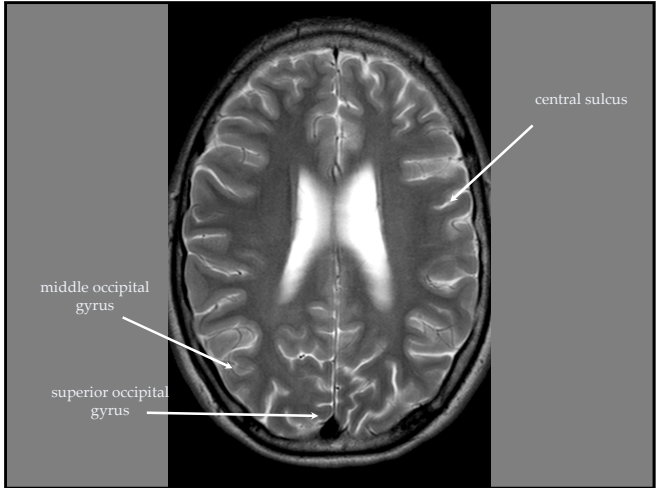
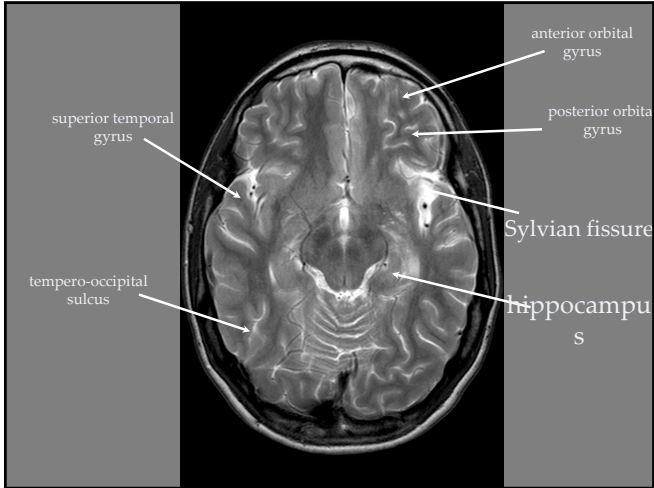
- Above: cuneus
- Below: calcarine gyrus

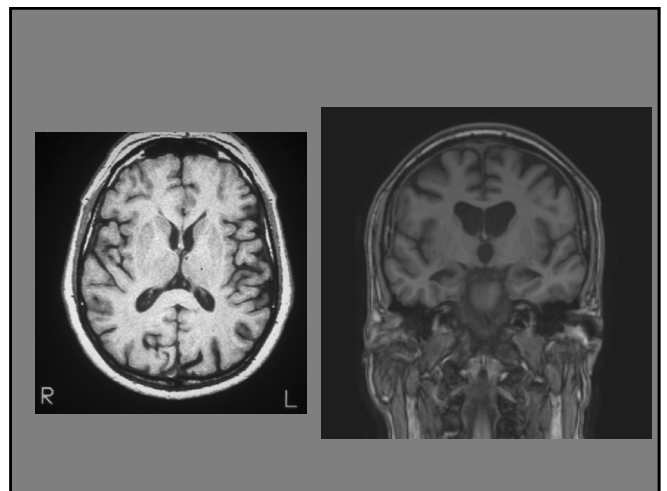
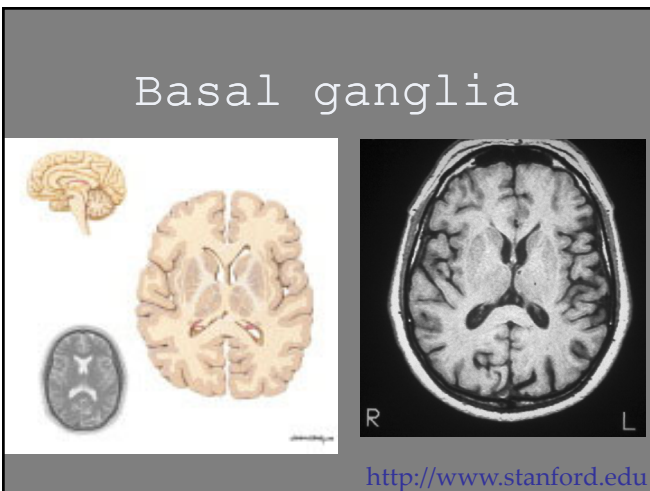
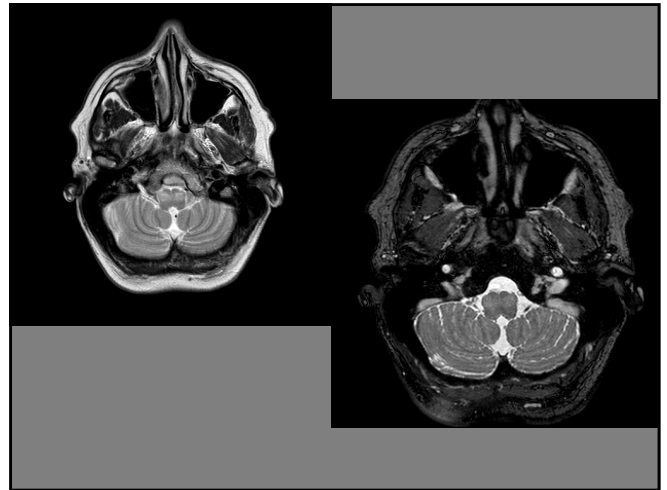
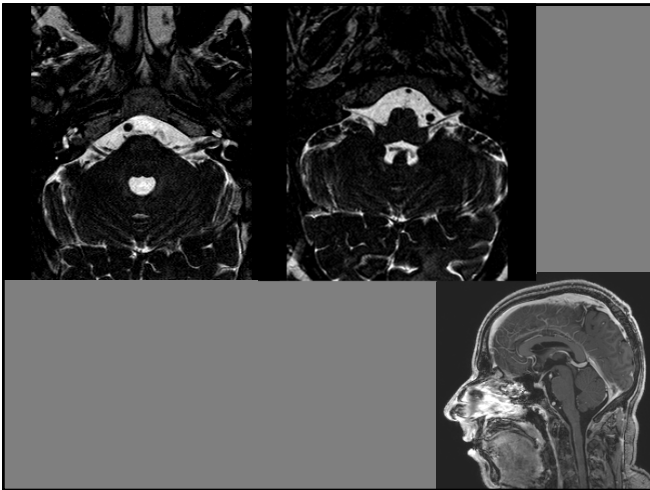
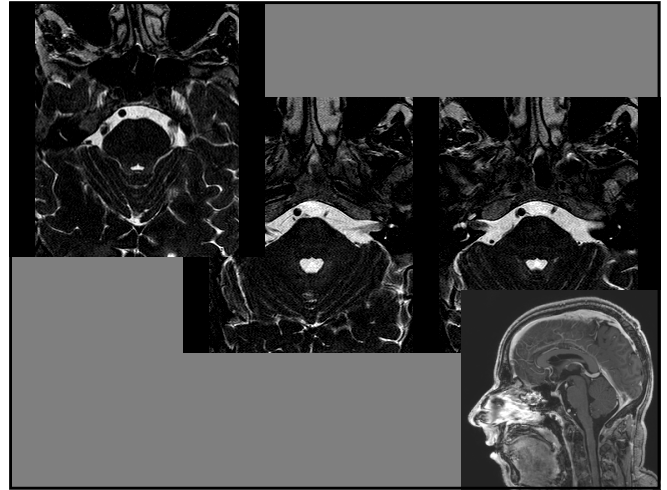
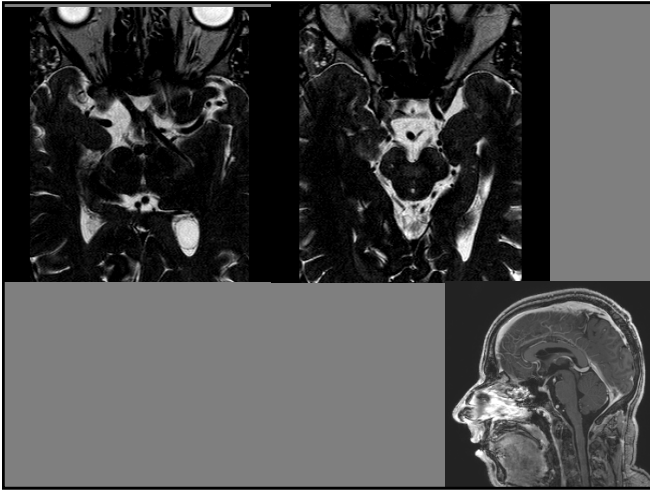
Lingual = temporo-occipital gyrus

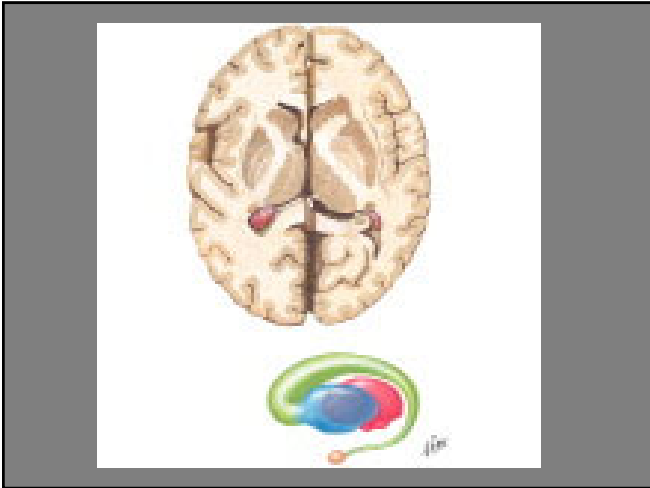










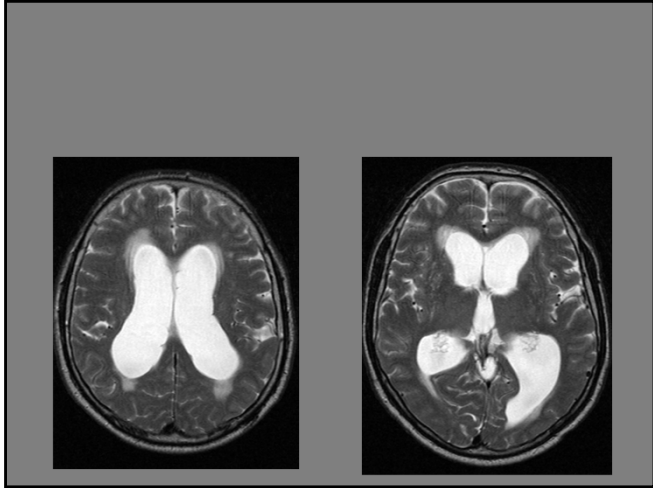
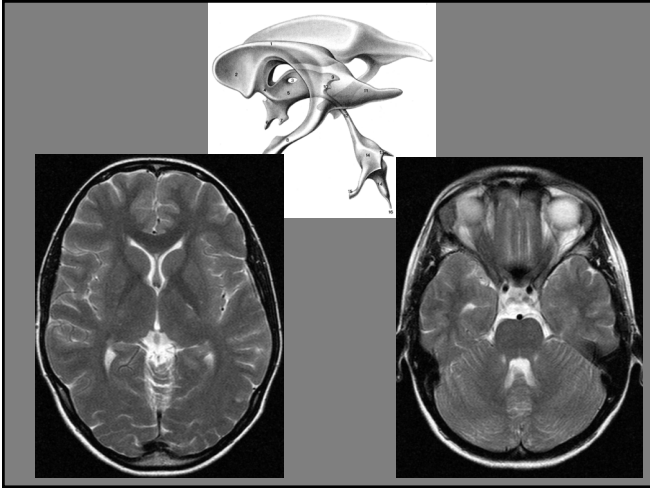
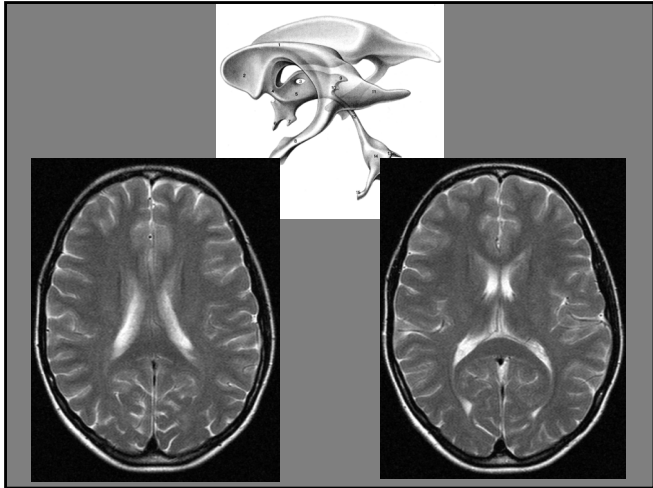


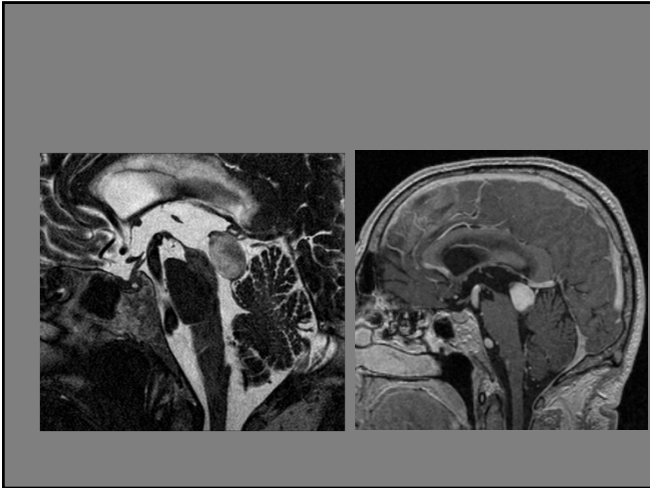
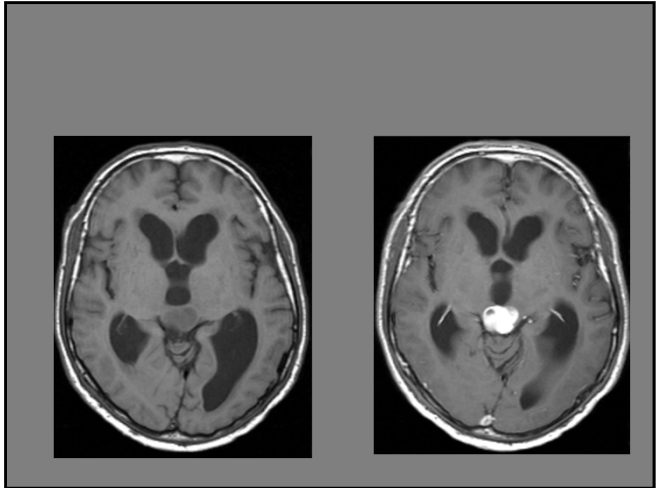
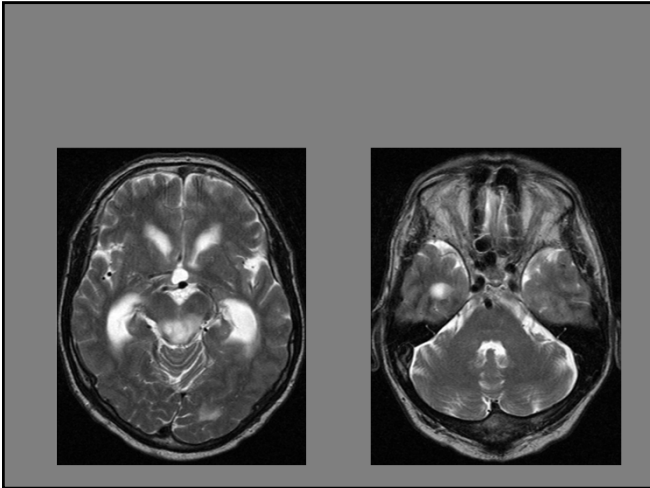
Clinical problem

30 years old female patient with headache and vomiting

CSF spaces

- Intra-cerebral CSF spaces
  - Ventricles
  - Aqueduct
- Extra-cerebral CSF spaces
  - Cisterns
  - Sulci



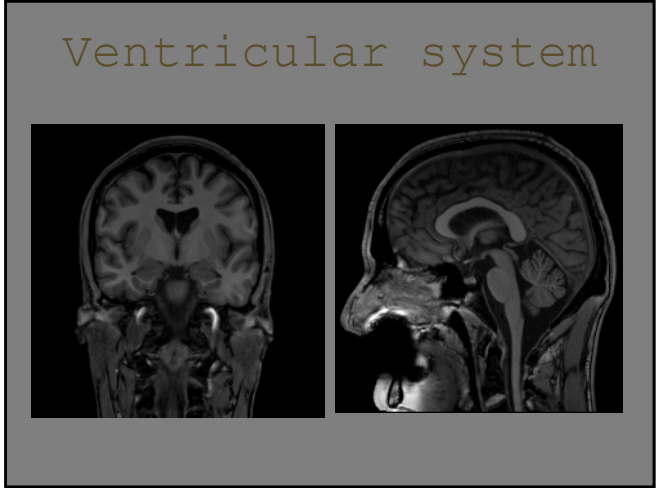


### Diagnosis

- Triventricular hydrocephaly
- Tumor lamina quadrigemina and compression aquaeductus cerebri

### Ventricular system

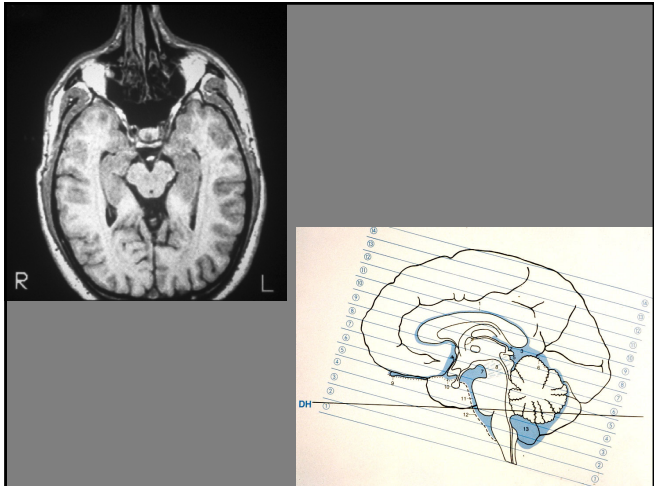
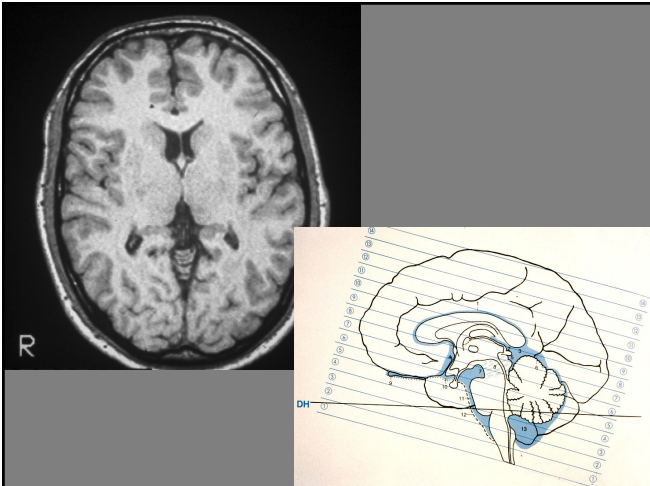
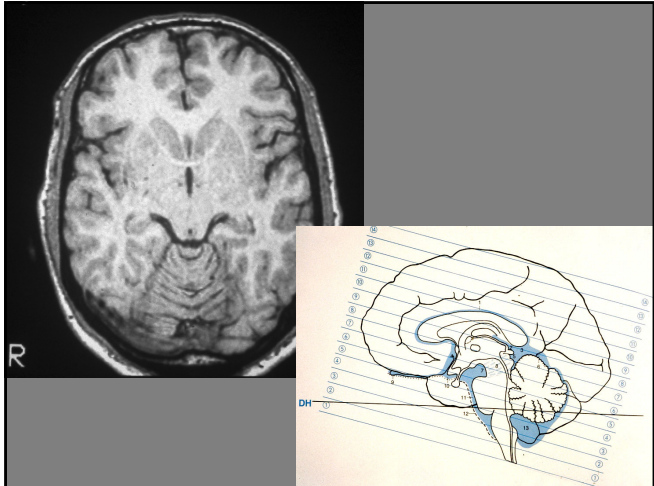
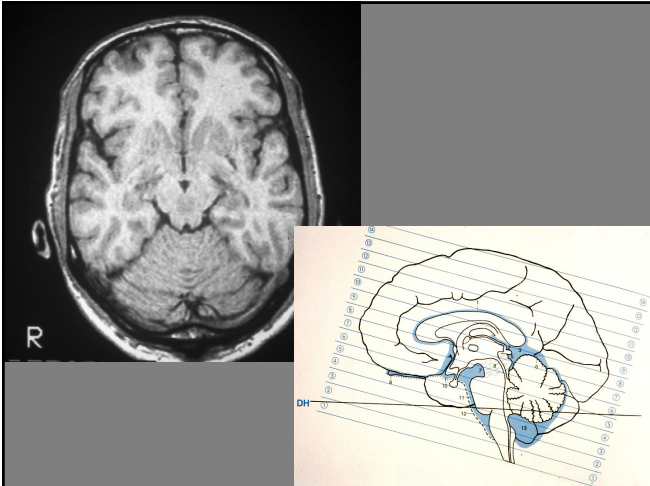
Diagnostic Imaging - Brain

A 3D reconstruction of the ventricular system, showing the lateral ventricles, the third ventricle, and the fourth ventricle. The ventricles are highlighted in a blue color against a dark background.

# Cisterns



Diagnostic Imaging - Brain

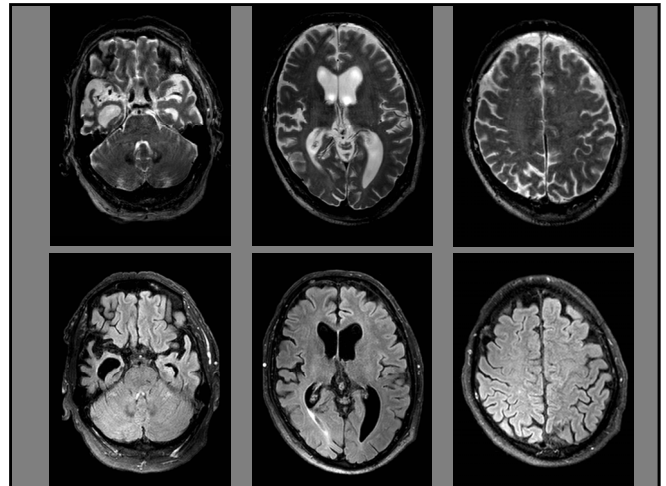
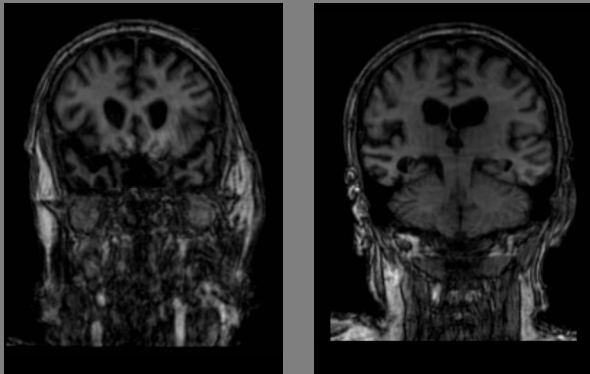


## Case 1

## Case 1

- 79 yrs old male
- Concentration problems
- Memory problems

## Case 1



## Diagnosis

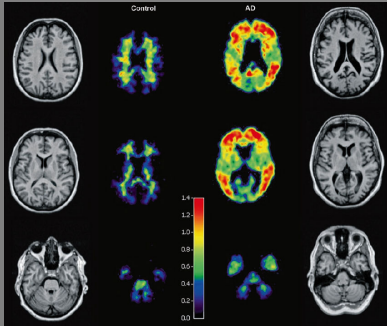
- Wide sulci
  - Wide temporal horns
  - 'knife blade' aspect
- Atrophy
- Temporal lobe > frontal, parietal, occipital
  - Hippocampal atrophy

## Diagnosis

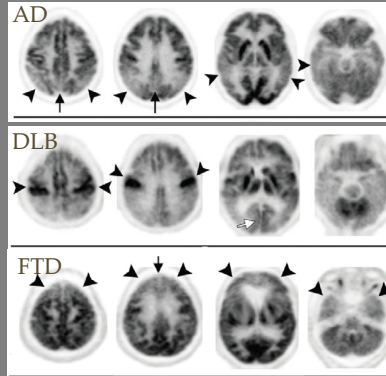
- Alzheimer disease

## Amyloid beta

- Non-specific binding in white matter.
- Amyloid tracer binding is diffuse and symmetrical, with high uptake consistently found in:
  - Frontal
  - Lateral temporal
  - Precuneus / Posterior cingulate gyrus
  - Temporoparietal
  - Striatum



## FDG-PET



Hypometabolism pattern:

AD  
 Posterior cingulate gyrus  
 Posterior temporal  
 Precuneus  
 Advanced disease: frontal

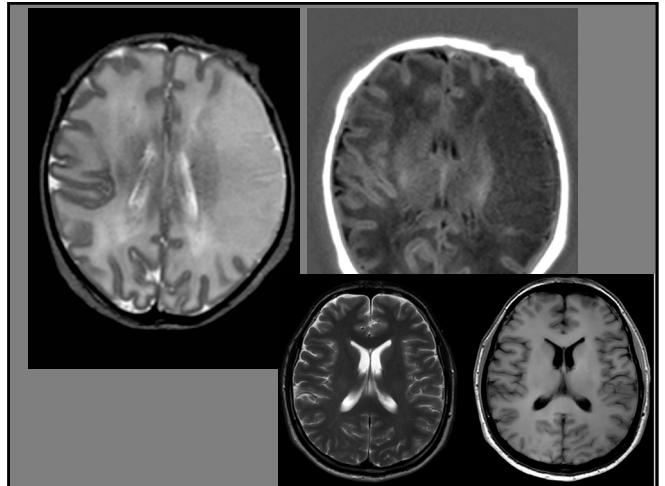
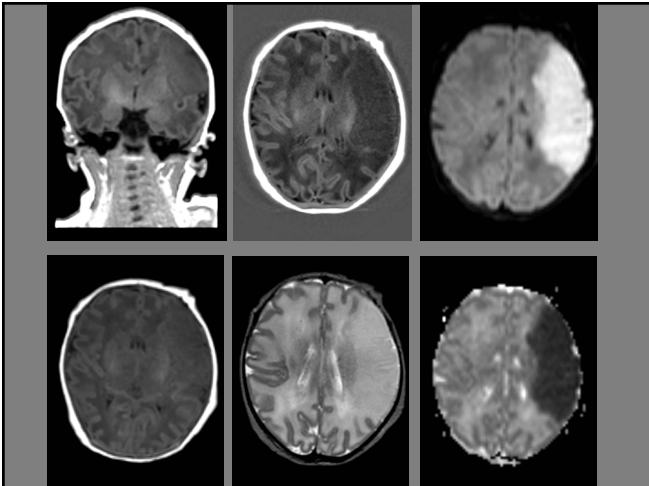
DLB  
 Posterior cingulate gyrus  
 Posterior temporal  
 Parietal  
 Occipital lobe (very specific)  
 Cerebellum

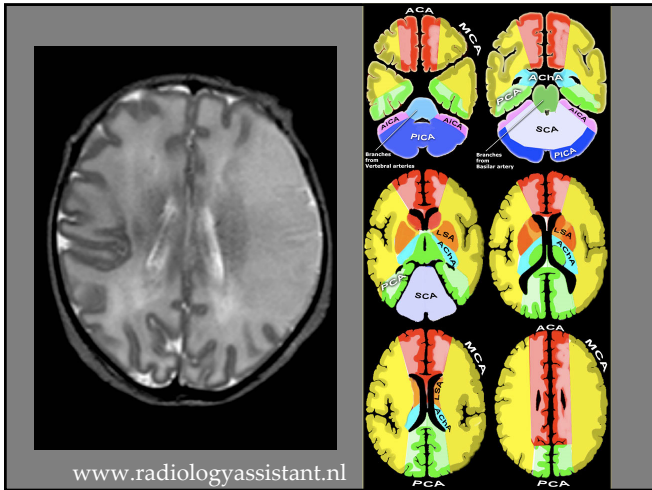
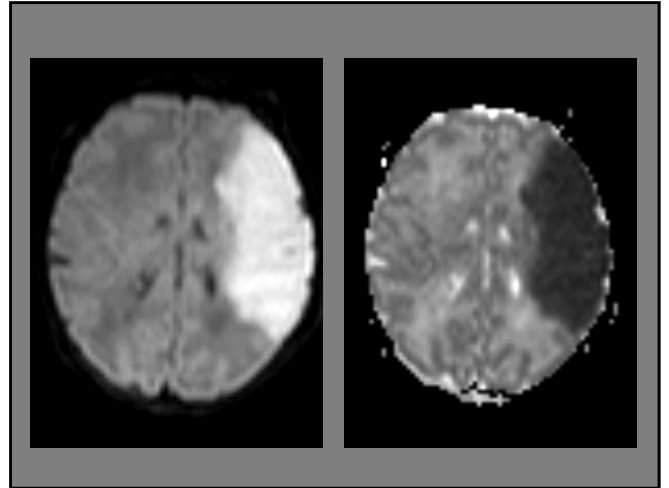
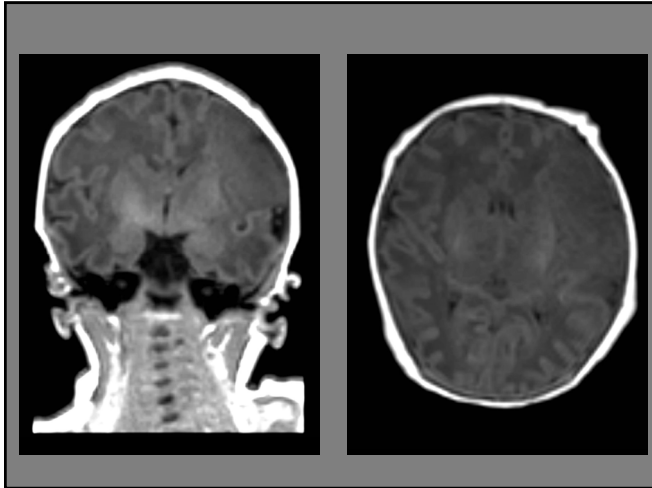
FTD  
 Frontal  
 Anterior temporal  
 Anterior cingulate gyrus

## Case 2

## Case 2

- 4 weeks old boy
- Hemiparalysis

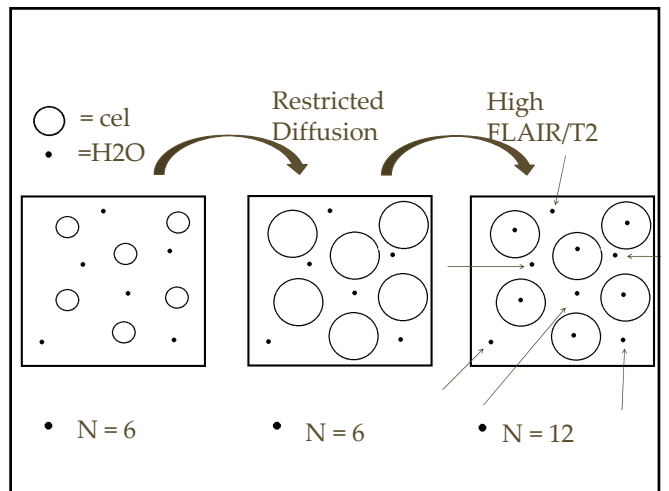
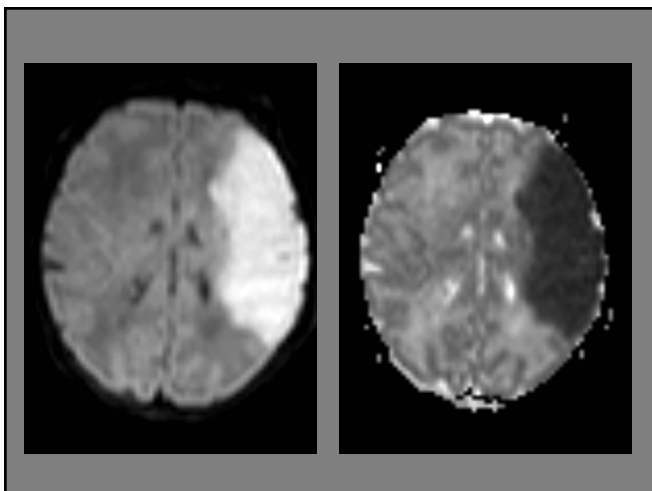




## Diagnosis

- Edema left hemisphere
- Cortex and white matter
- Restricted diffusion (cytotoxic edema)
- Vascular territory
- Middle cerebral artery

• ! Myelinisation is still in progress at 4 weeks. This is normal, and will show a difference in signalintensity of the white matter compared to adult patients. !





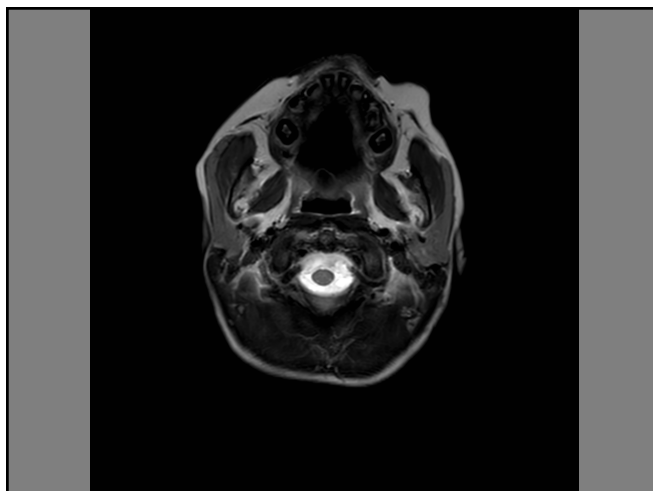
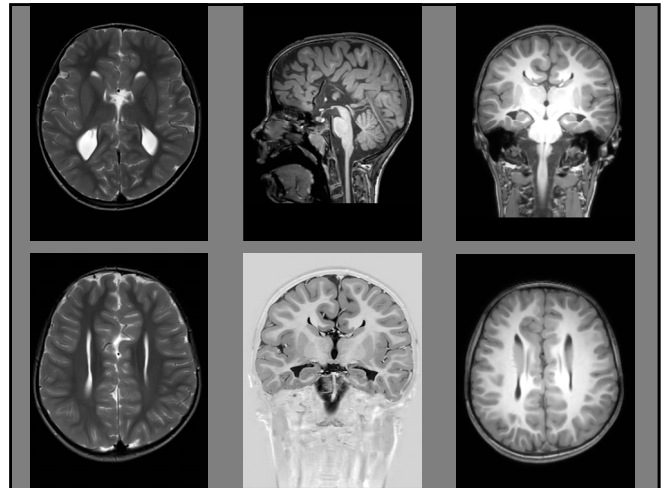
## Diagnosis

- Ischemic stroke middle cerebral artery

## Case 3

## Case 3

- 4 yrs old girl
- Normal myelinization
- Congenital brainmalformation



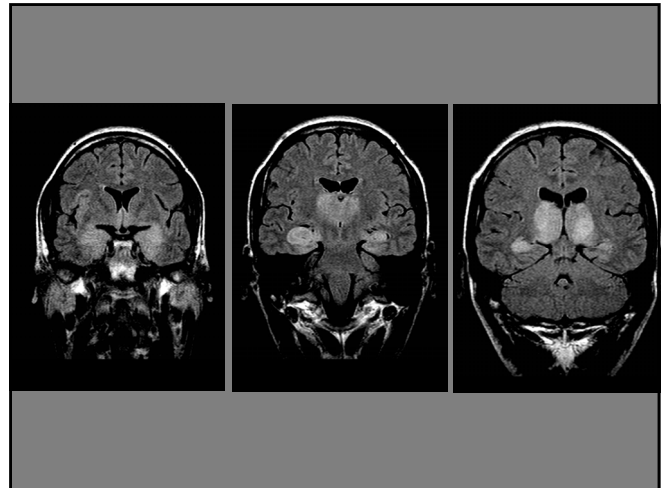
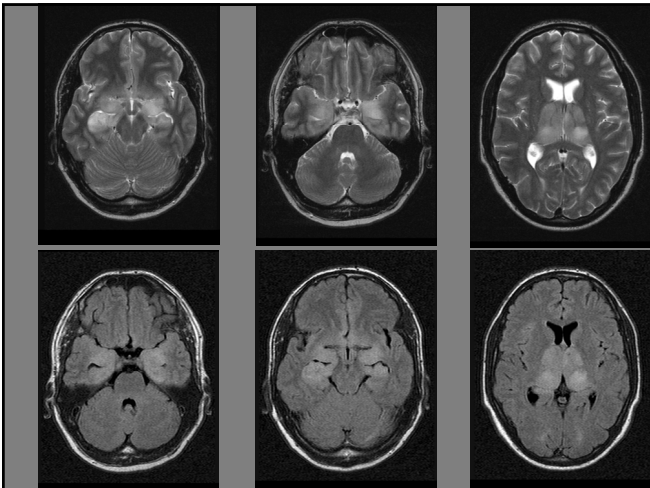
## Diagnosis

- Parallel ventricles
- Small frontal horns, dilated occipital horns (colpocephaly)

## Diagnosis

- Corpus callosum agenesis

## Case 4



## Diagnosis

- Hyperintensity of:
  - Hippocampus
  - Mesotemporal lobe
  - Thalami
- Bilateral

## Diagnosis

- Limbic encephalitis