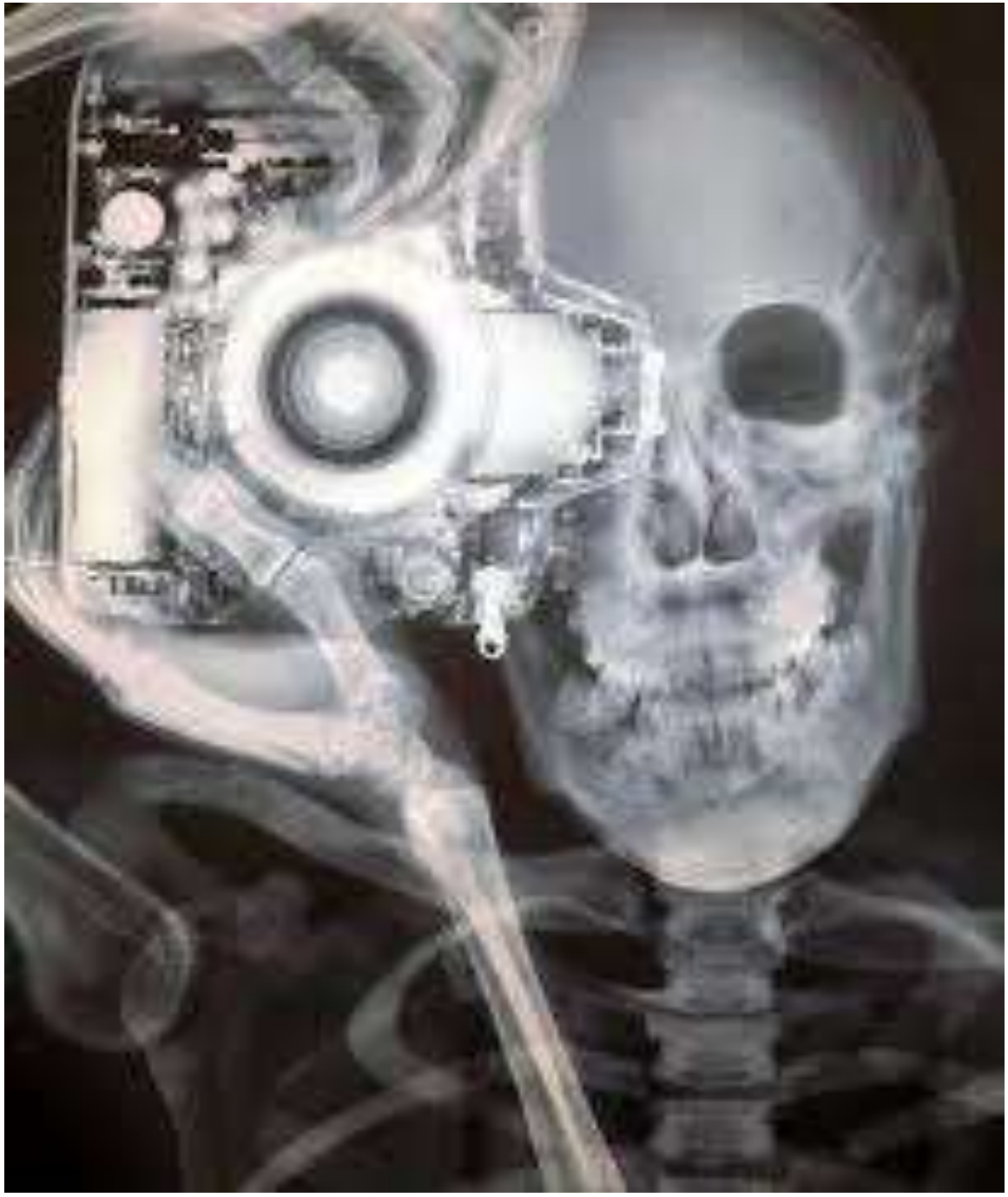
Neuro modalities of imaging 2022-2023

DR. HANA QUDSIEH MD



CT SCAN (CAT SCAN)


CT scanner
A.D.A.M.

CAT SCAN (PATIENT SPEECH)

- WATCH THIS VIDEO

  https://youtu.be/XDZR6QPOMiE

YOU HAVE TO NOTICE AFTER THE FORMER VIDEO

- 1.SHAPE OF CAT MACHINE
- 2-DURATION OF SCAN
- 3-WHAT DID HER FATHER WEAR IN CAT ROOM?? WHY???
- 4-WHERE DID THE TECHNICIAN SIT FOR MONITORING??? AND WHY??

CAT SCAN TECHNIQUE

- WHAT IS THE BASIC MECHNISM ???

- https://youtu.be/tqGmqRrxajQ

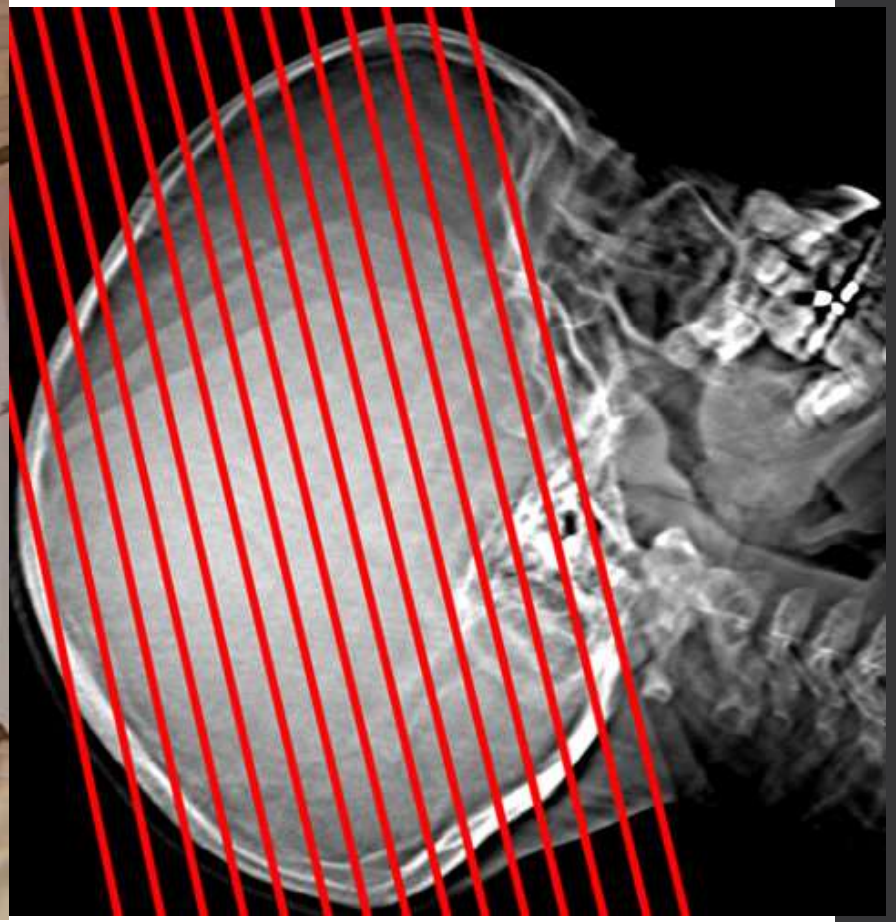
CT (CAT)SCAN

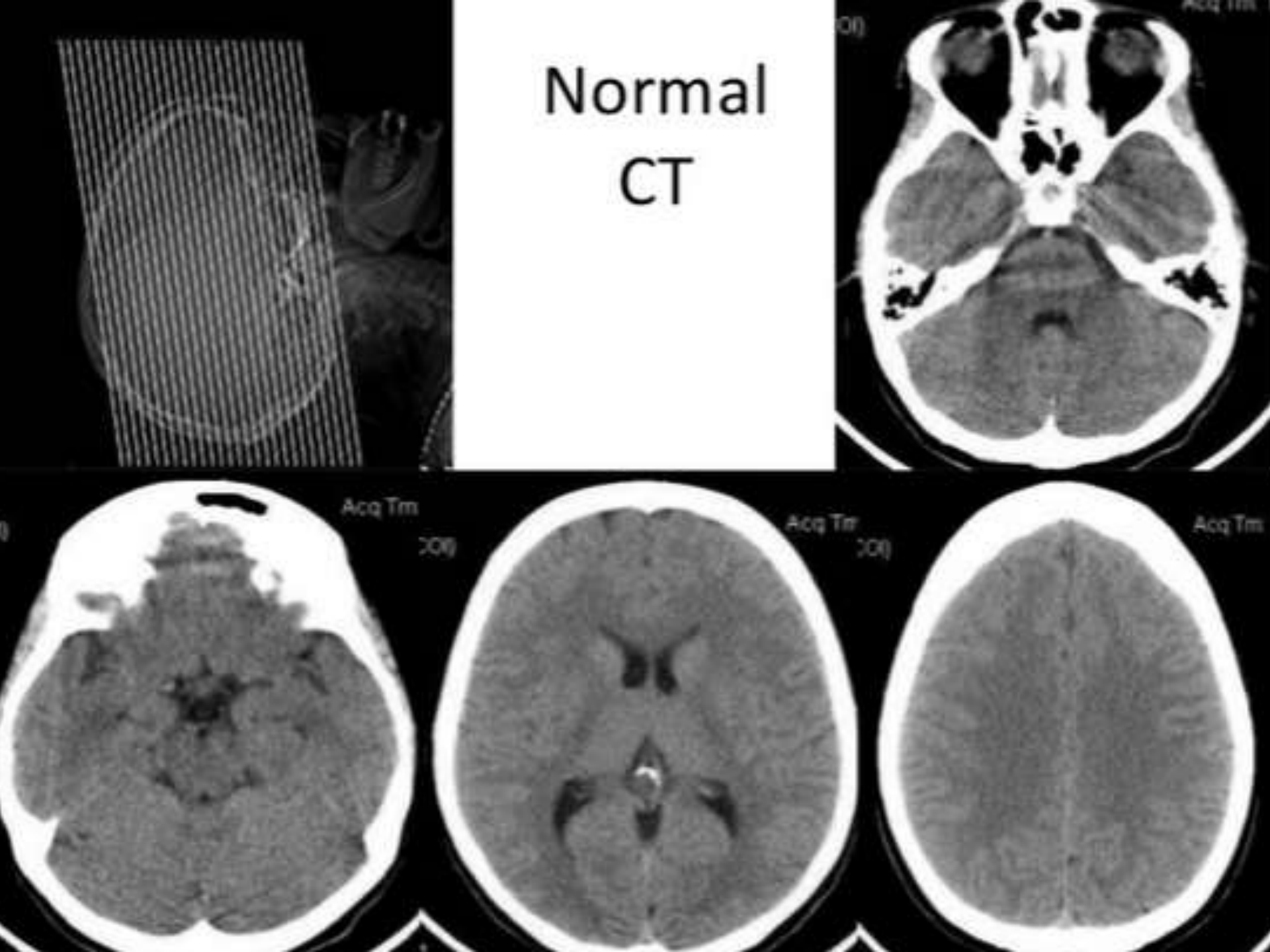
- IT IS MULTIPLE **X-RAYS** BEAM THAT PENETRATE THE SCANNED AREA AND RECEIVED BY DETECTORS AND THEN ANALYSED BY COMPUTER

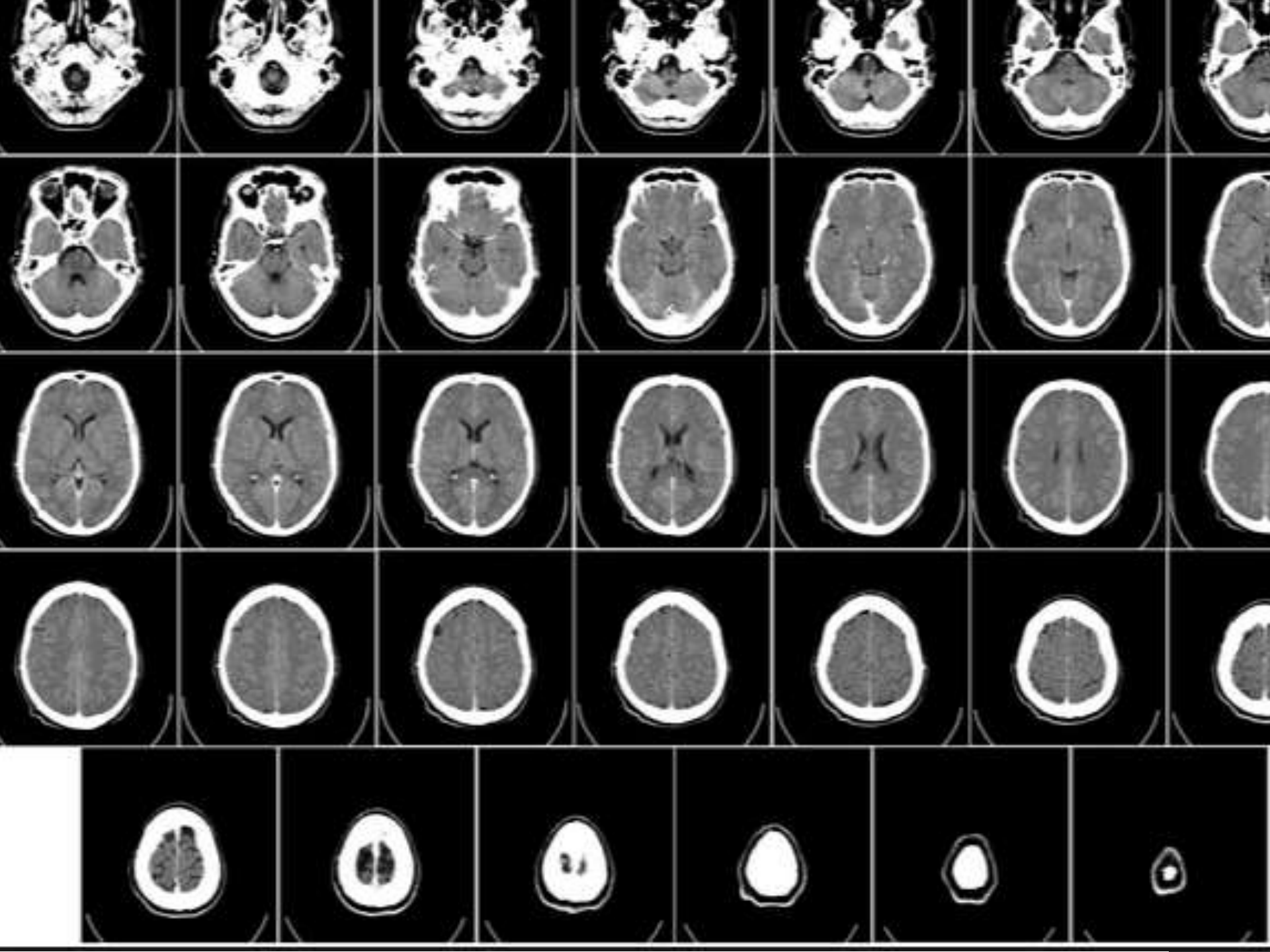
- INDICATION OF BRAIN CT:
- 1-HEAD INJURY.
- 2-HEAD INFECTION (IN A COMBINATION WITH CONTRAST MEDIA)
- 3-BRAIN HEMORRHAGE (SENSITIVE)
- 4-STROKE WE MAY NEED CTA (STUDY OF VESSEL WITH CONTRAST MEDIA).
- 5-INCREASE INTRACRANIAL PRESSURE (HYDROCEPHALUS)
- 6-OTHERS; DEMENTIA TUMOR SEIZURE.

In order to perform a head CT, the patient is placed on the CT table in a supine position and the tube rotates around the patient in the gantry. In order to prevent unnecessary irradiation of the orbits and especially the lenses, Head CTs are performed at an angle parallel to the base of the skull. Slice thickness may vary, but in general, it is between 5 and 10 mm for a routine Head CT. Intravenous contrast is not routinely used, but may be useful for evaluation of tumors, cerebral infections, and in some cases for the evaluation of stroke patients.

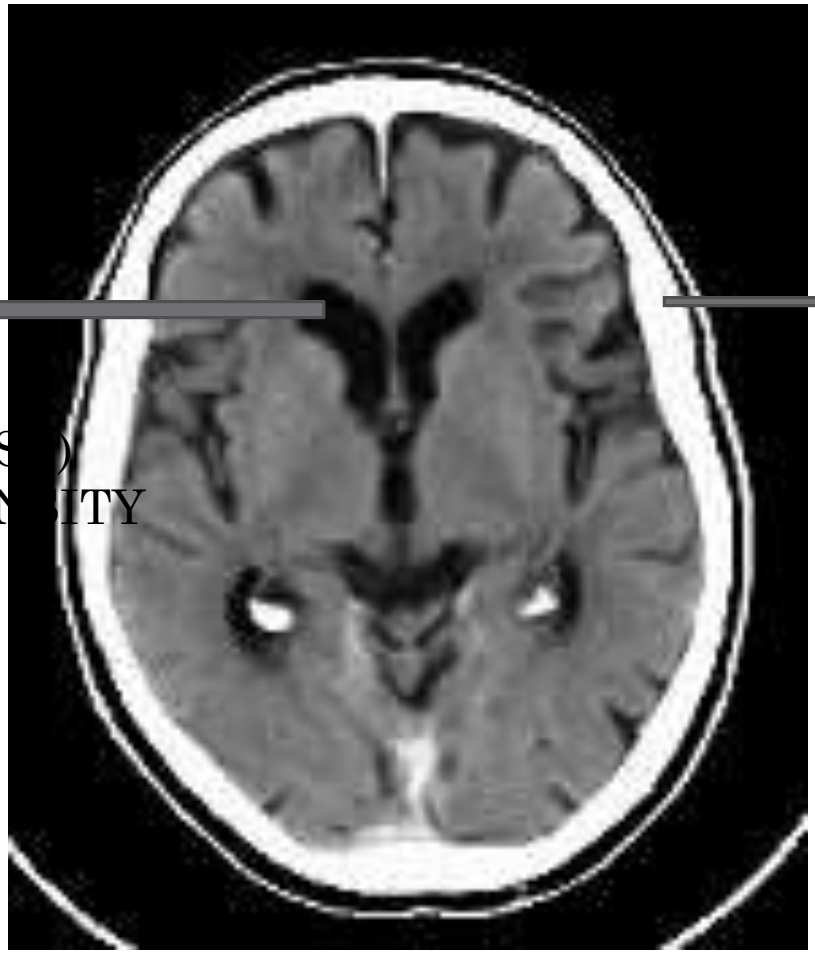
BRAIN CT ANGULATION SEEN IN SCOUT




Normal
CT
Acq Tm
Acq Tm
Acq Tm



Densities description



FLUID DENSITY (HYPODENS) OR CSF DEN ITY

HYPERDENSE BONE

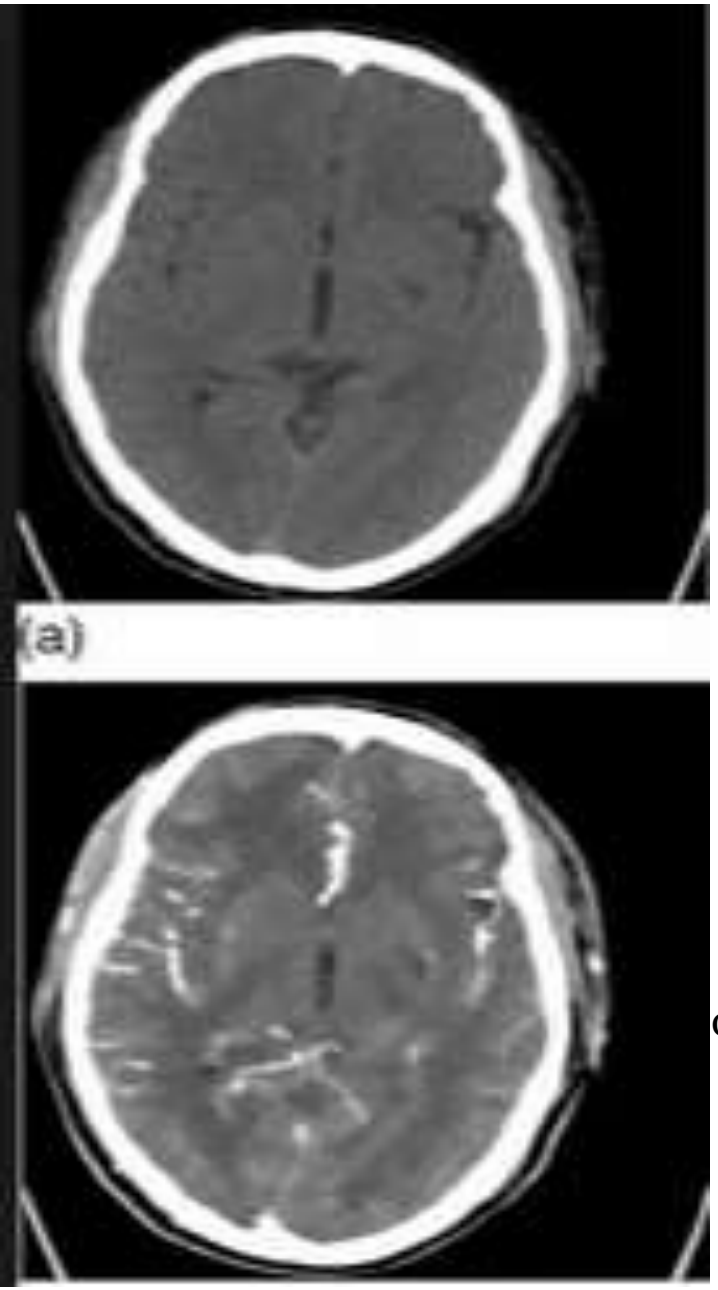
HYPODENS
FAT

HYPODENSE
GAS

ISODENSE
LESION

HYPODENSE
SUBCAUTANEOUS
FAT

CONTRAST MEDIA



Without CM (non enhanced) plain

with CM (enhanced) the

dense

are

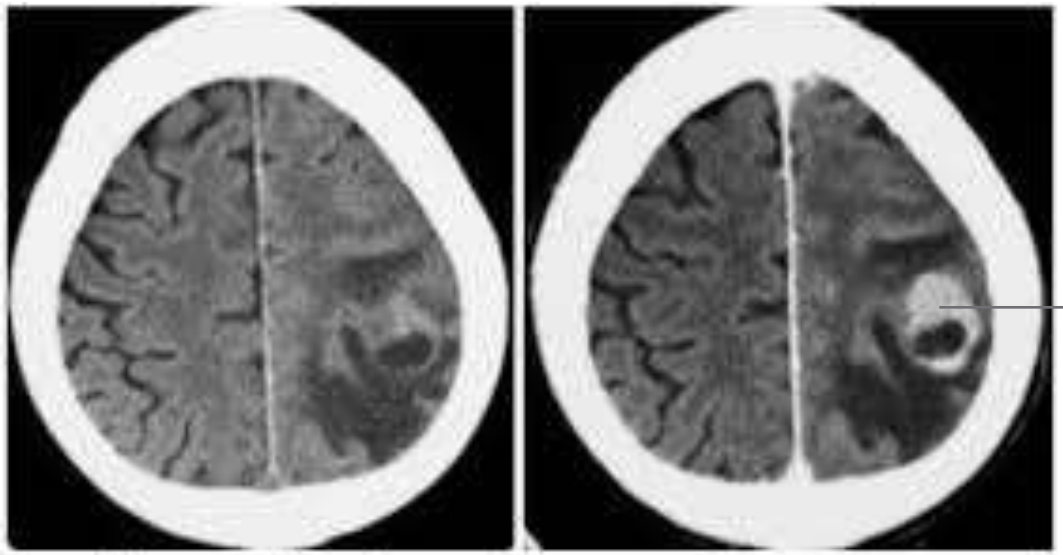
I.V. CONTRAST MEDIA

NICM:NON IODINATED CONTRAST MEDIA

- INDICATION OF CONTRAST
- 1-TUMOUR: DIFFERENT TUMOURS HAVE DIFFERENT PATTERN OF ENHANCEMENT.
- 2-INFECTION. LIKE ABCESS
- 3-VASCULAR ASSESSMENT

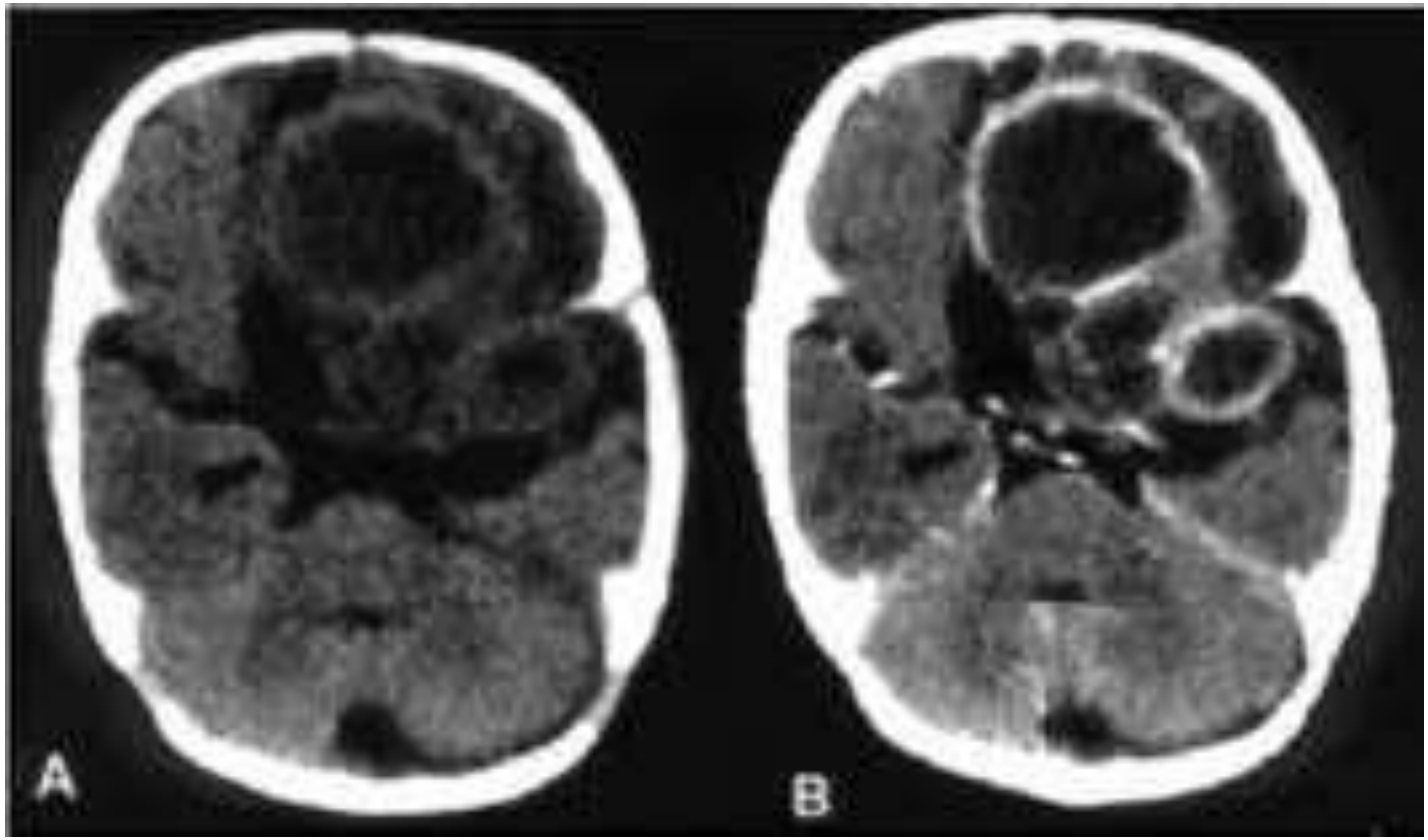
METS

- ENHANCEMENT :UPTAKE OF CONTRAST MEDIA

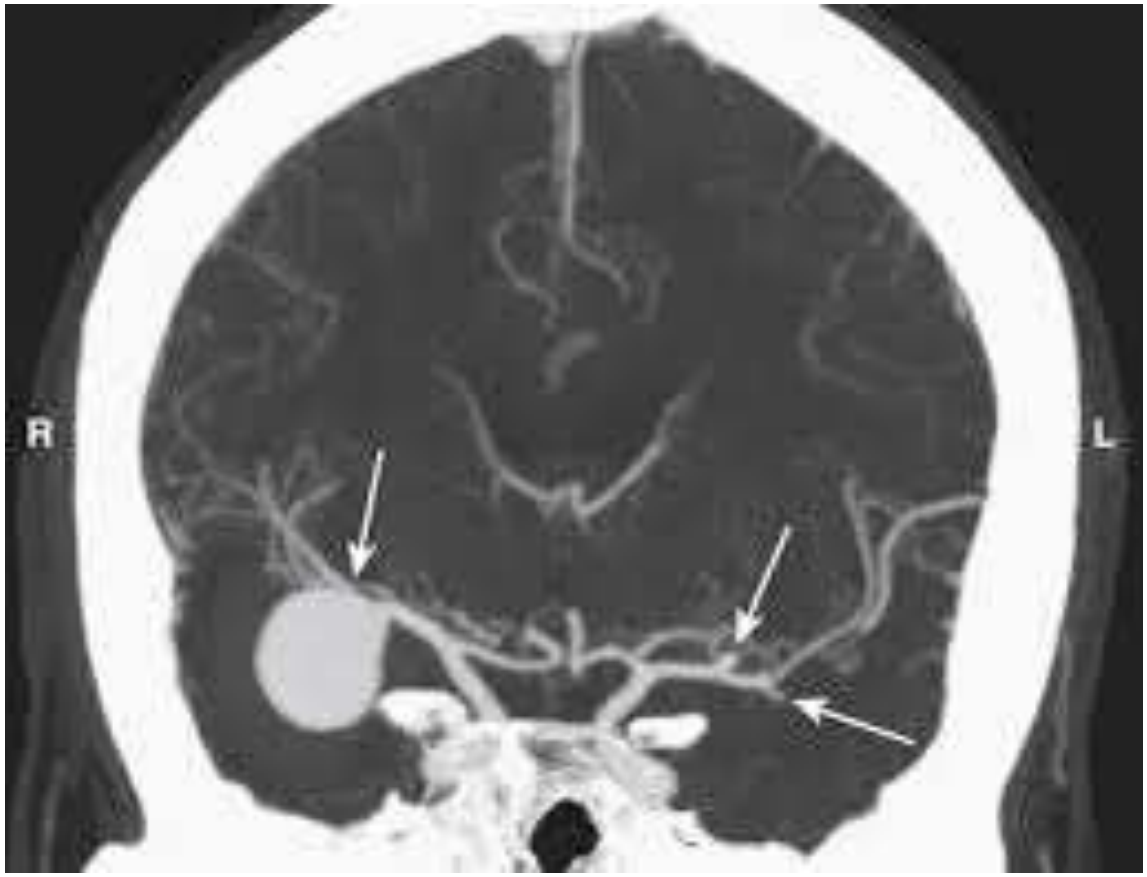


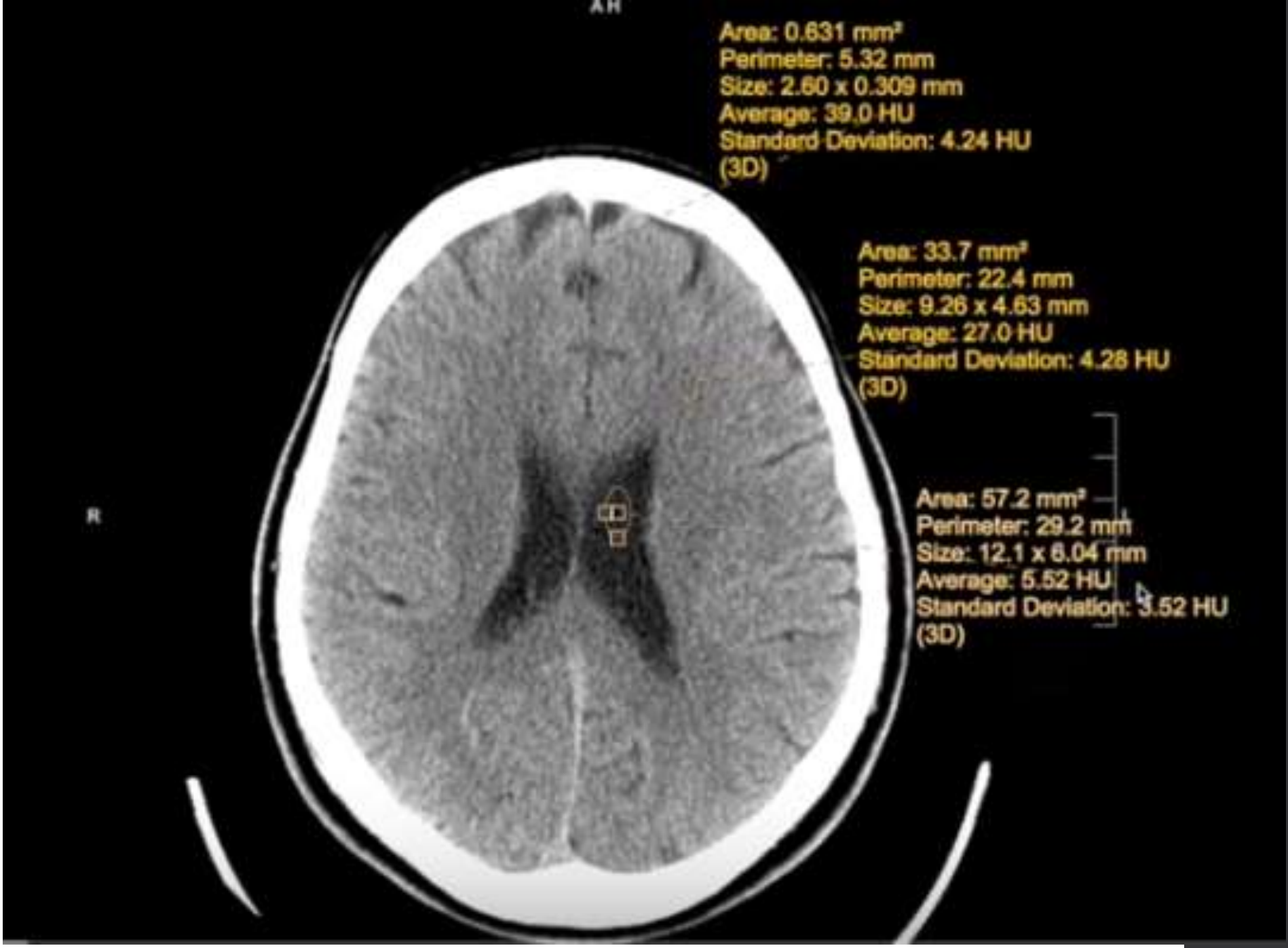
ENHANCEMENT

ABCESS:RING ENHANCEMENT

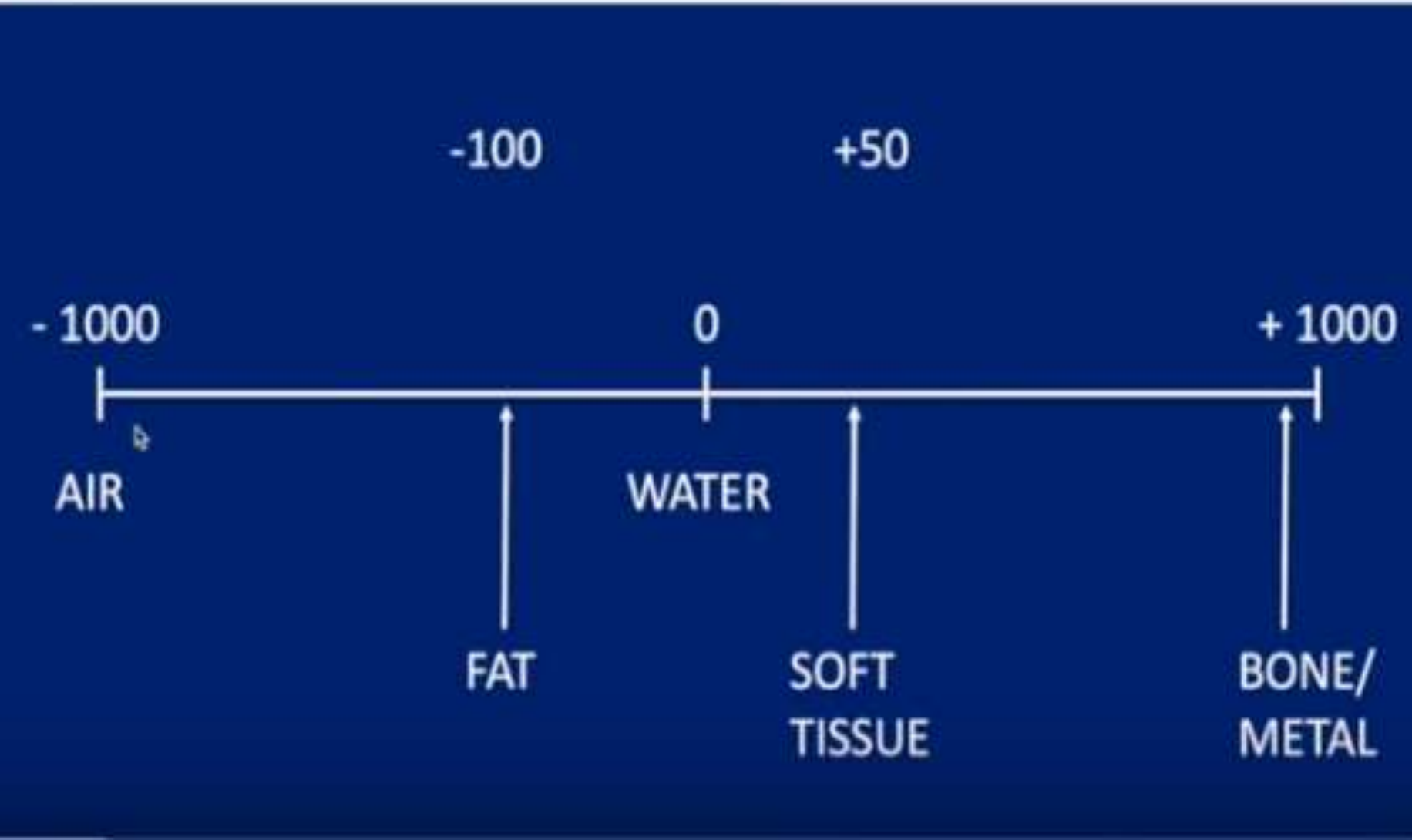


Mca ANEURYSM IN cta




Area: 0.631 mm²
Perimeter: 5.32 mm
Size: 2.60 x 0.309 mm
Average: 39.0 HU
Standard Deviation: 4.24 HU
(3D)
Area: 33.7 mm²
Perimeter: 22.4 mm
Size: 9.26 x 4.63 mm
Average: 27.0 HU
Standard Deviation: 4.28 HU
(3D)
Area: 57.2 mm²
Perimeter: 29.2 mm
Size: 12.1 x 6.04 mm
Average: 5.52 HU
Standard Deviation: 3.52 HU
(3D)
R

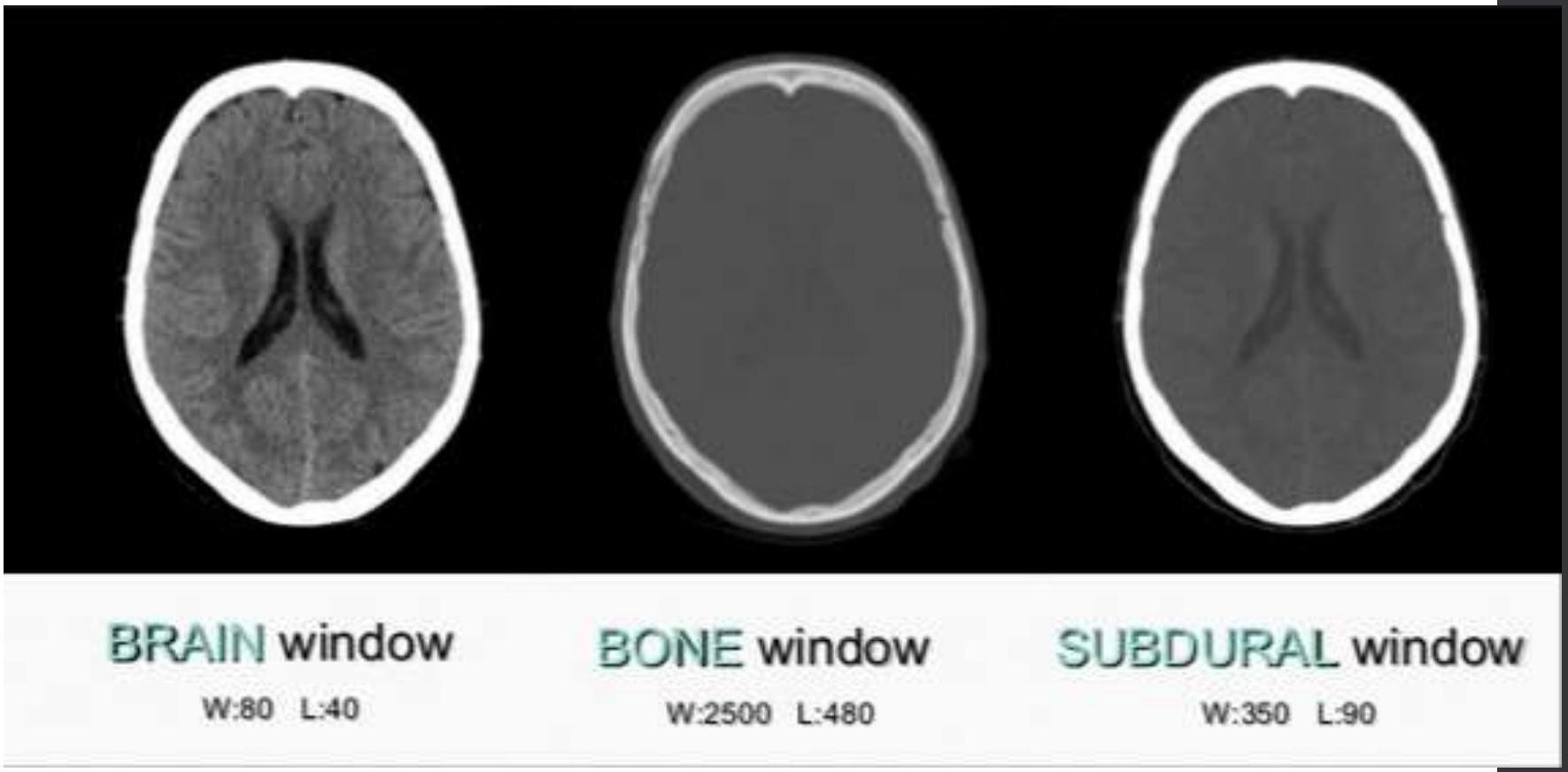
Review: Hounsfield Units



CT DENSITY MEASUREMENT

- Hounsfield units
- Water-0HU
- Air- -1000 HU
- Calcification- +1000HU
- Fat-100HU
- CSF-3HU
- Grey matter-38HU
- White matter-30HU
- Fresh blood-70-80HU

WINDOWS


BRAIN window
W:80 L:40
BONE window
W:2500 L:480
SUBDURAL window
W:350 L:90

MRI

MRI VIDEO

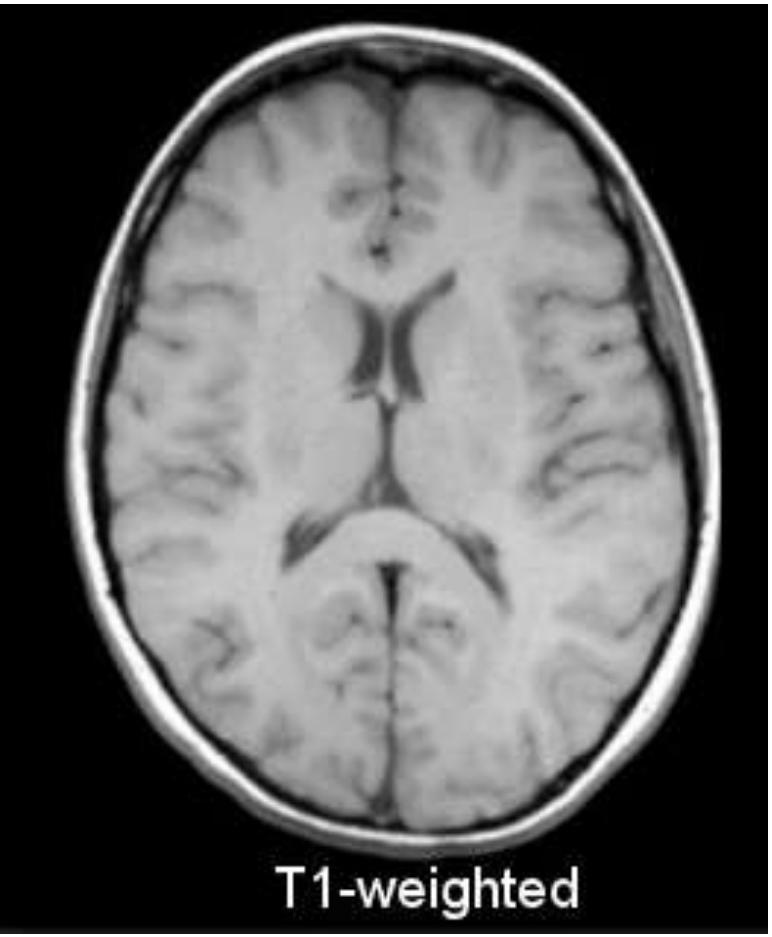
- HAVE YOU EVER SEEN MRI MACHINE ???????

- WOULD YOU LIKE TO GO WITH TOMAS TO SEE HIM SCANNED WITH MRI????
- LETS GOOOOOOOOOOOO
- https://youtu.be/bxt-DXsMKDc
- BUT…..

YOU HAVE TO NOTICE

- 1-SHAPE OF MACHINE
- 2-SAFTEY MEASURES
- 2-DURATION OF SCAN

T1WI'S



RECOGNITION

- Fat is bright
- Water is dark
- New blood is bright

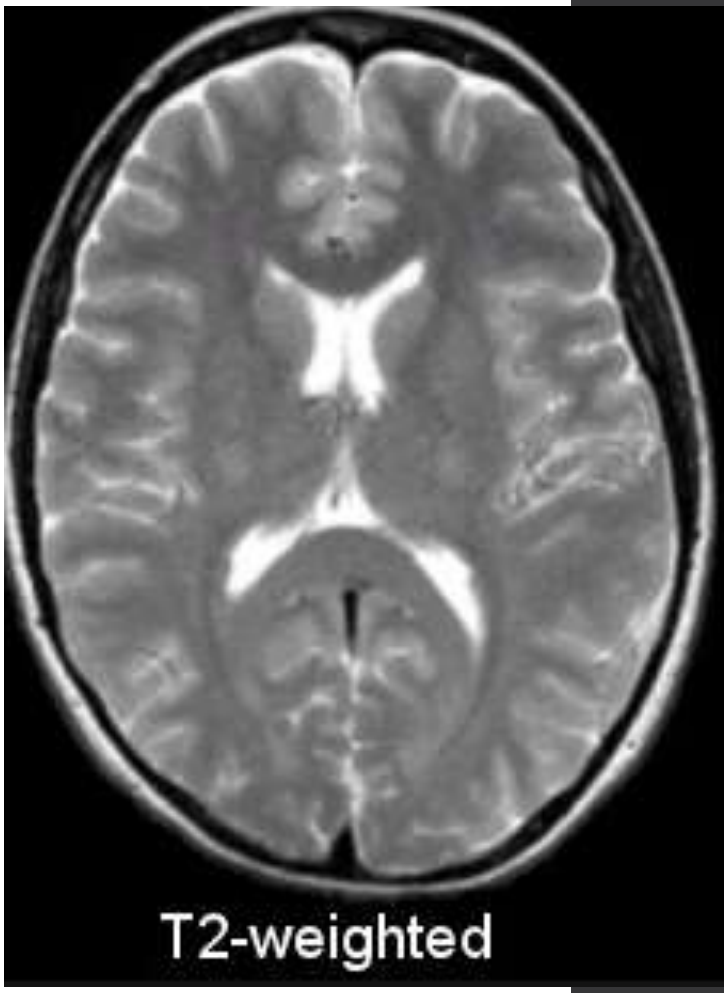
USEFUL FOR

- Anatomic detail
- Vascular changes +C
- Disruption of BBB +C

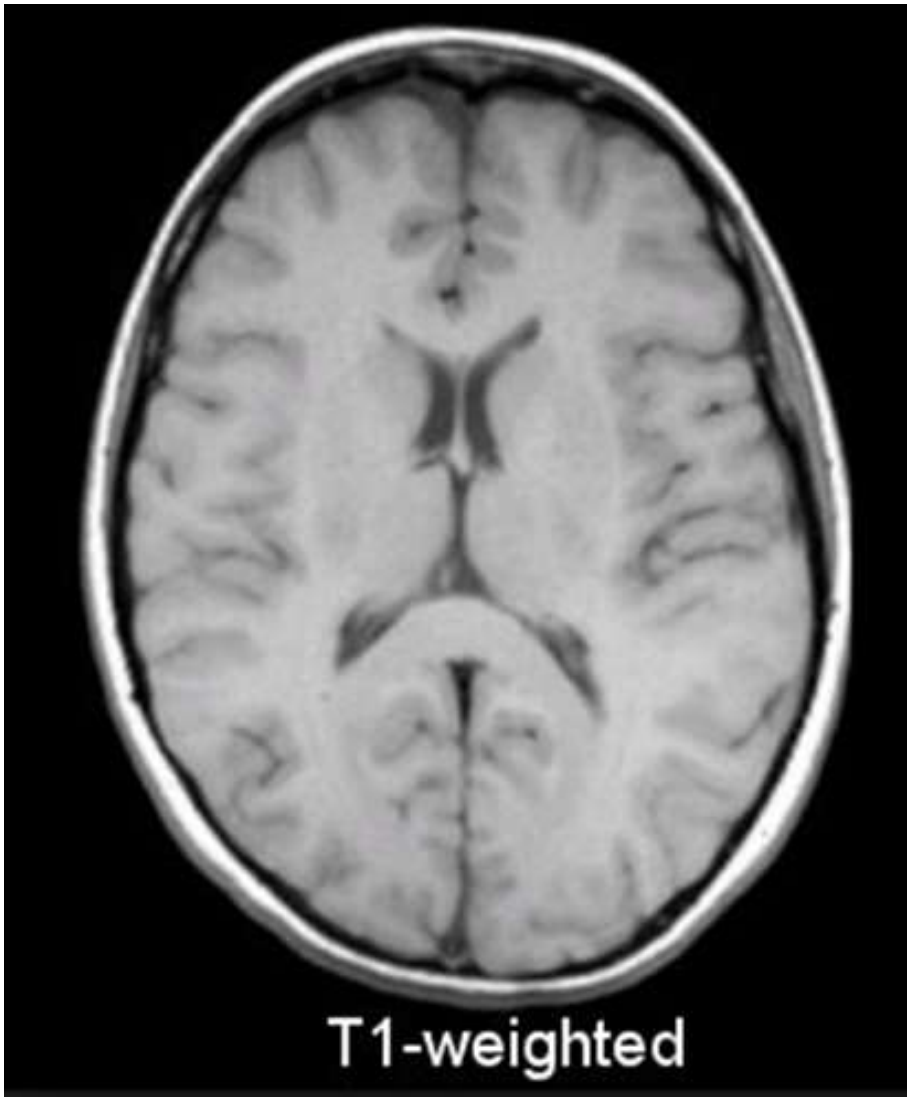
T2WI'S

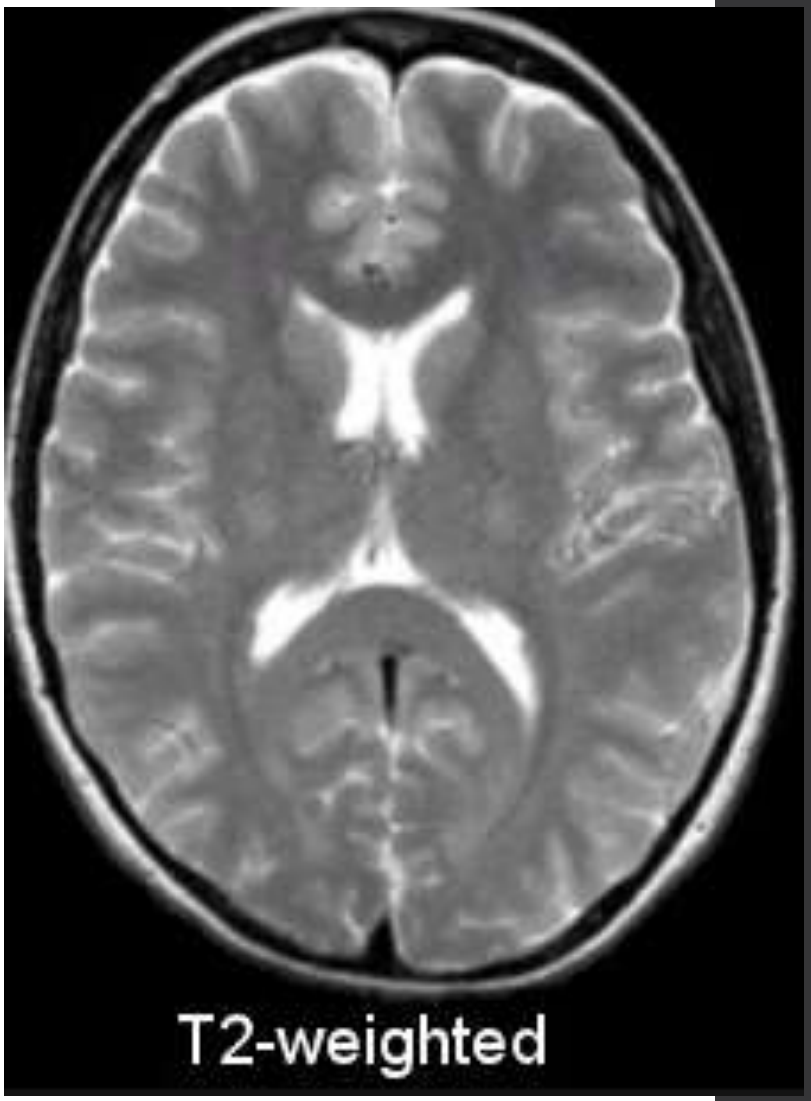
RECOGNITION:
1-WHITE MATTER IS DARKER
2-FLUID IS BRIGHT
3-SIGNAL VOIDE BLOOD FLOW

USEFUL IN MOST LESIONS BUT CANNOT DISTINGUISH EDEMA FROM CSF

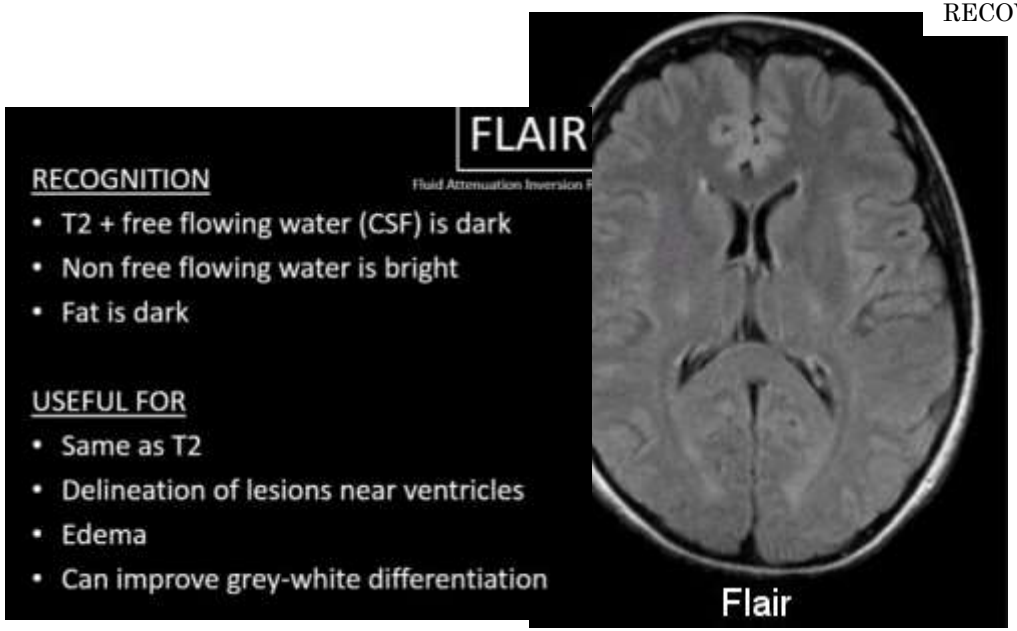


T1 VS T2



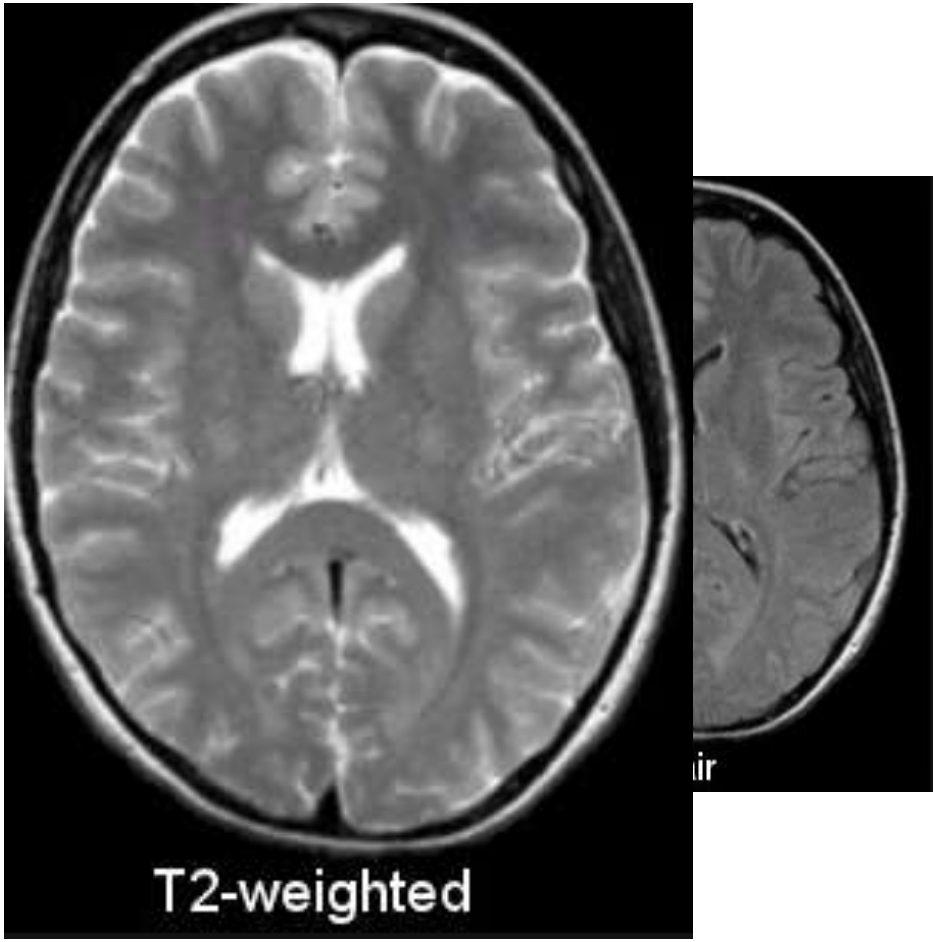


FLAIR

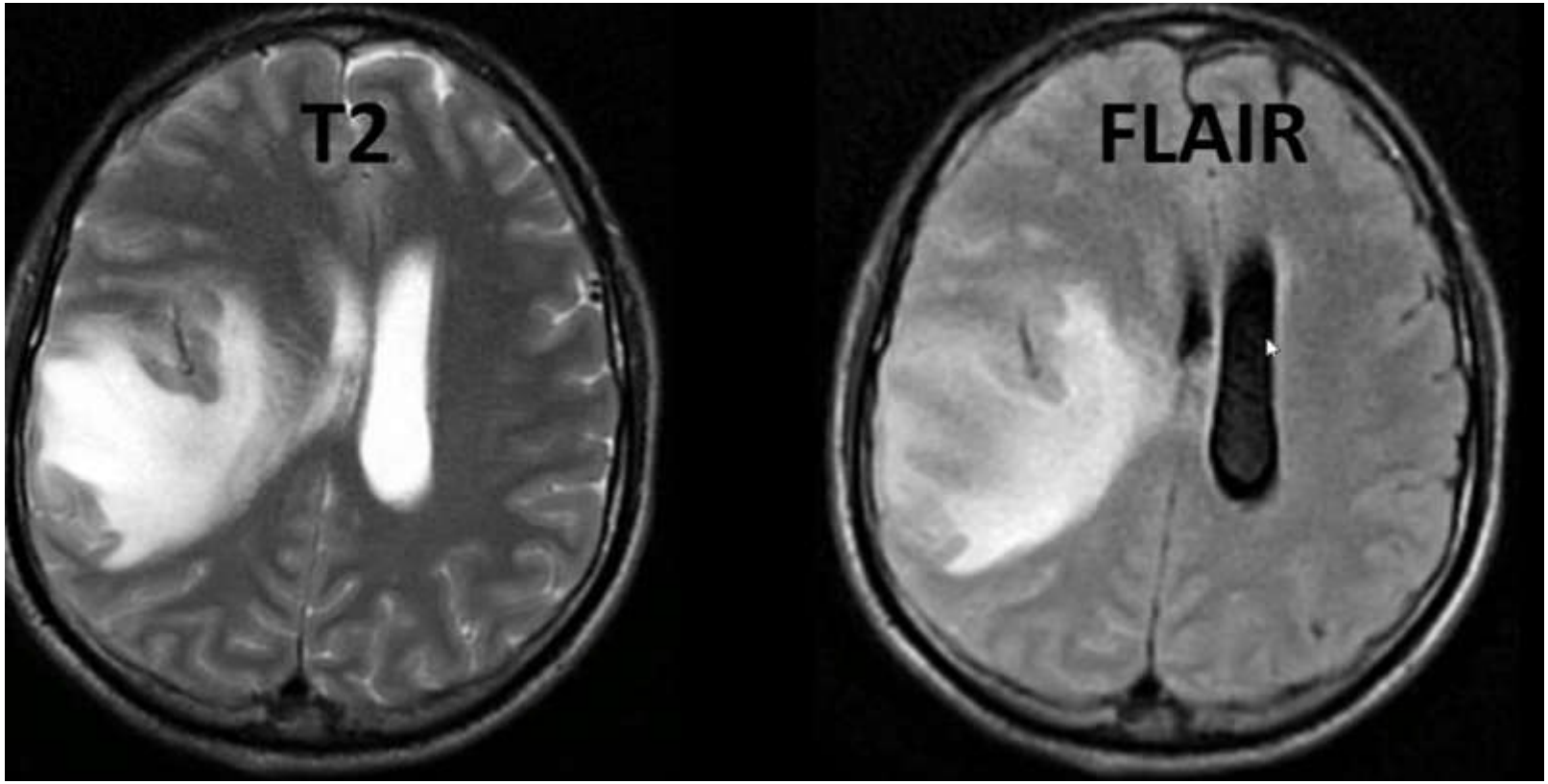


RECOVERY

T2 VS FLAIR



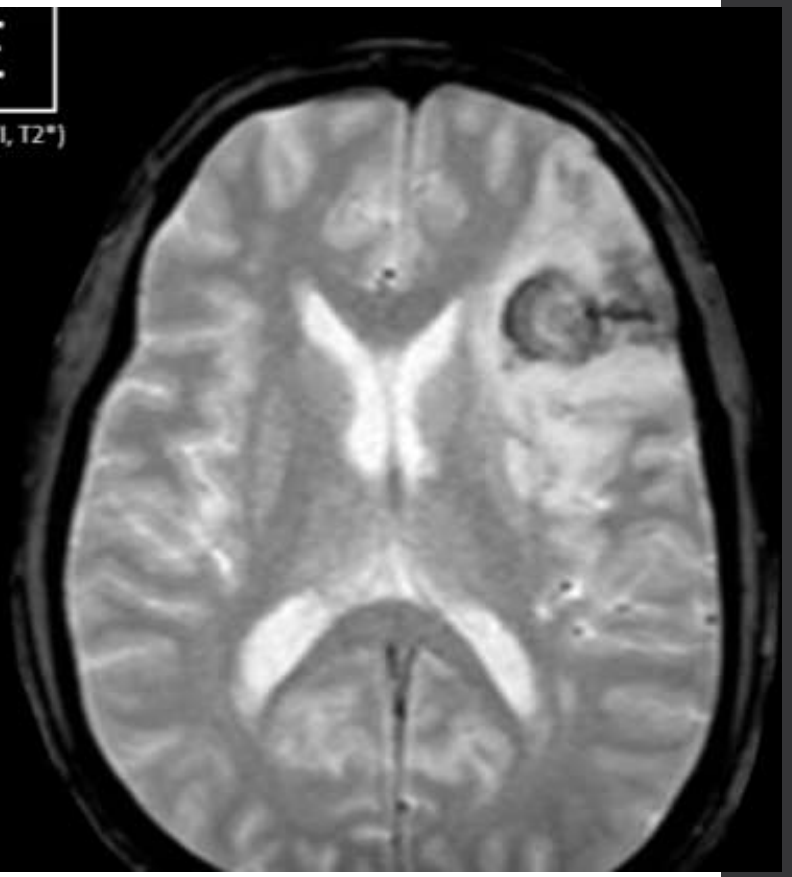
CSF OR EDEMA



GRADIENT ECHO

GRE

Gradient Echo (SWI, T2*)



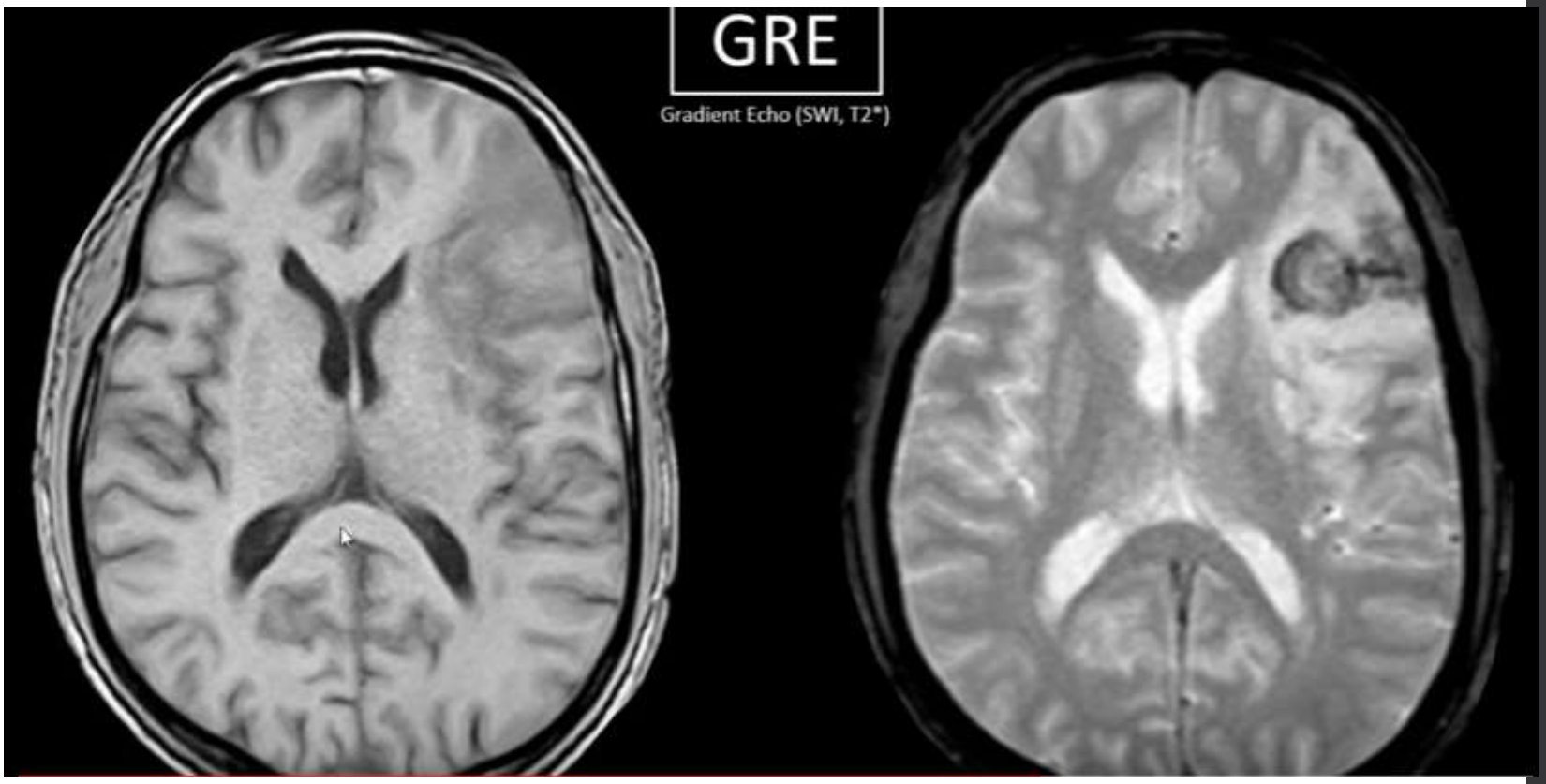
RECOGNITION

- Paramagnetic substances are dark
  - Blood
  - Calcium
  - Other metals

USEFUL FOR

- Early Hemorrhage
- Old Hemorrhage

T1 VS GE



DWI

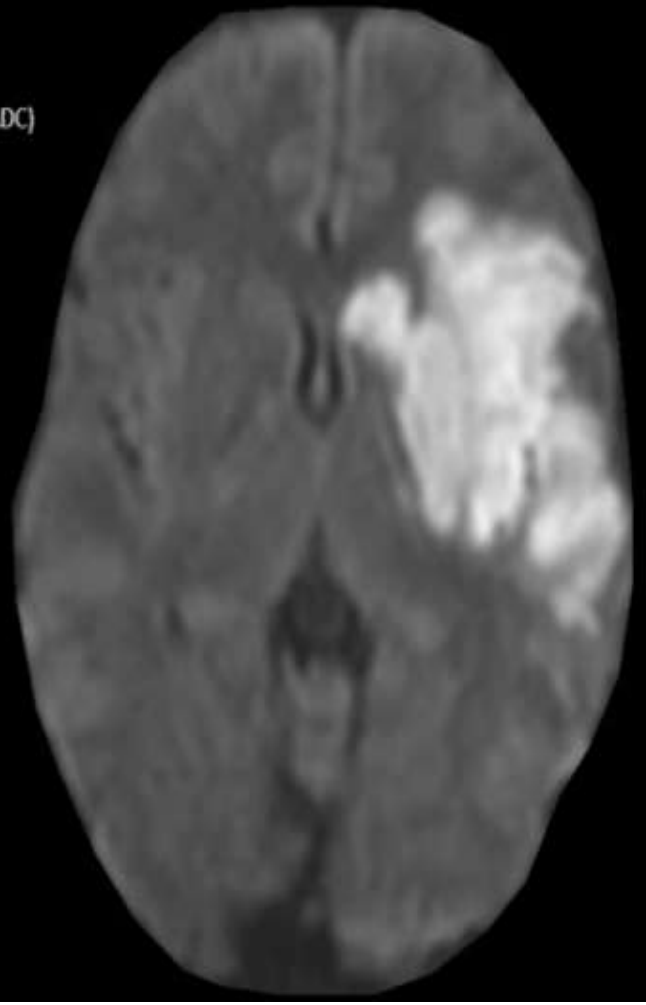
Diffusion Weighted Imaging (ADC)

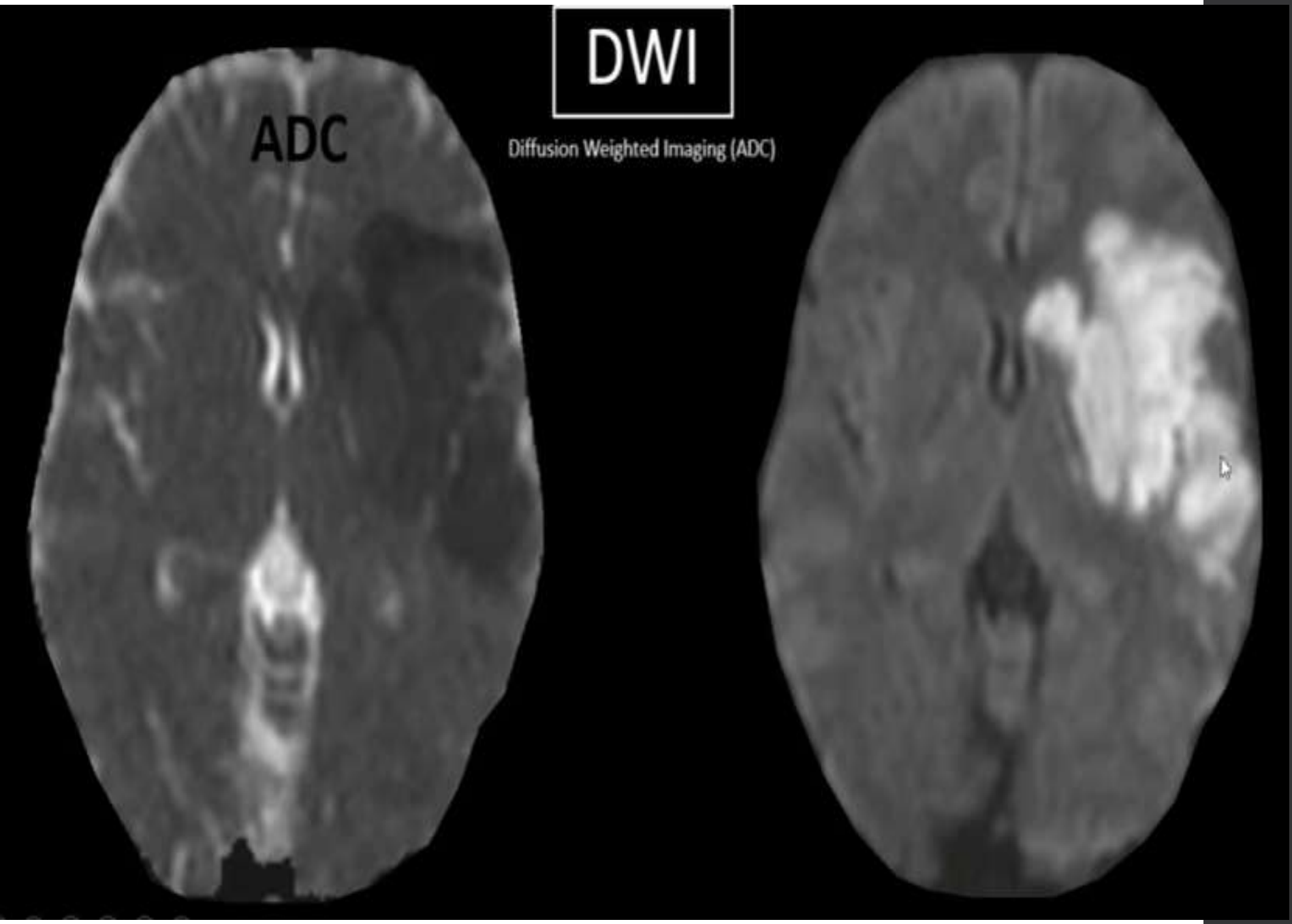
RECOGNITION

- Fluid restriction is bright (cytotoxic edema)
- Must correlate with ADC
  - Fluid restriction is dark
  - Rule out "T2 Shine Through"

USEFUL FOR

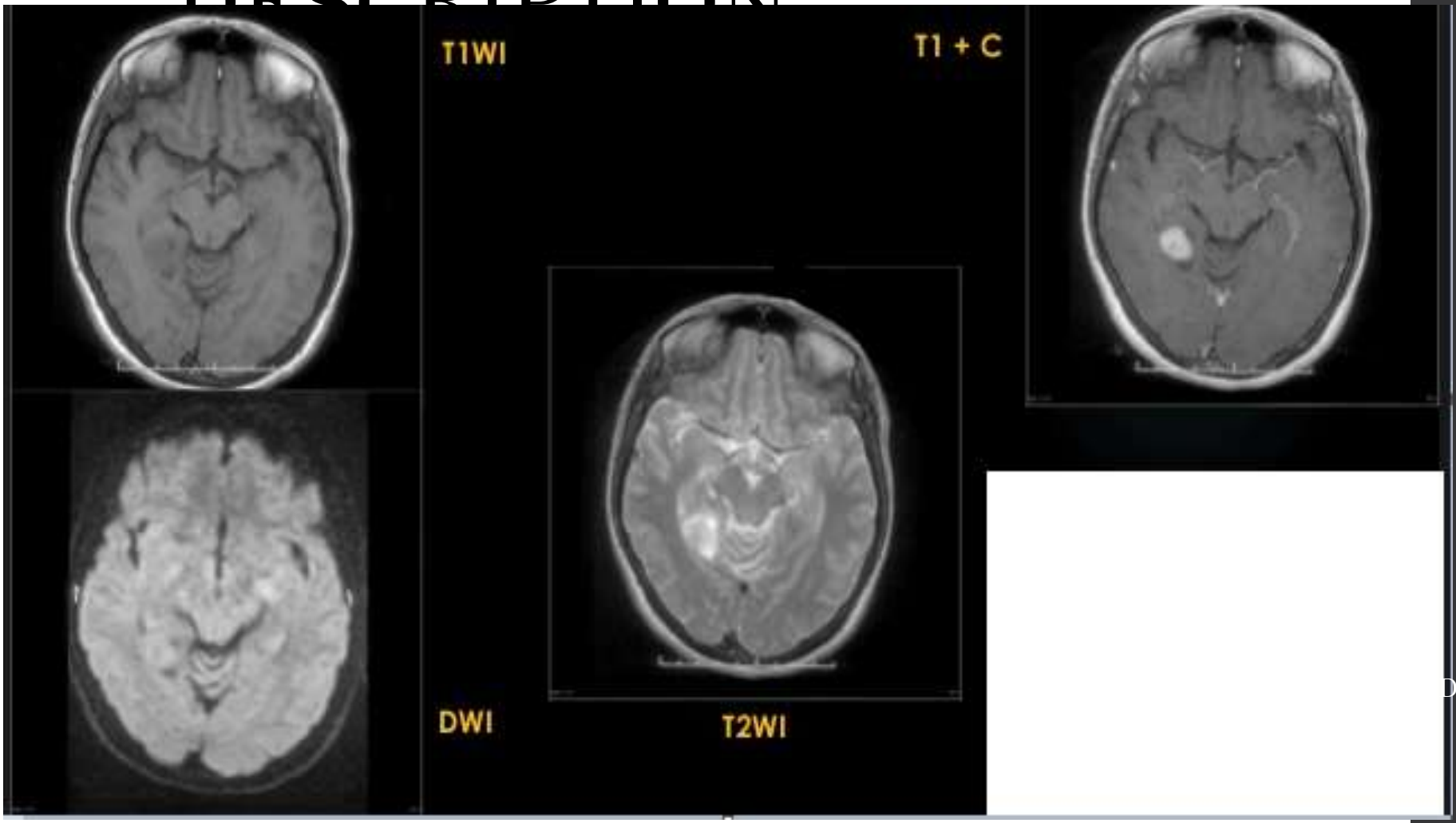
- Ischemia
- Abscess




DWI
ADC
Diffusion Weighted Imaging (ADC)

MRI *or* CT

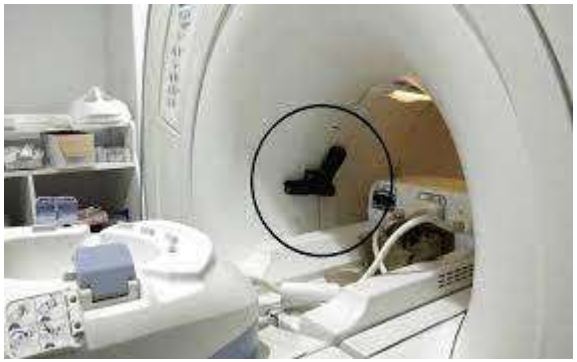
DESCRIPTION



DWI'S

MRI ACCIDENTS


PHILIPS



WORST MRI ACCIDENTS

- https://www.google.com/url?sa=i&url=https%3A%2F%2Fm.facebook.com%2FTheInfographicsShow%2Fvideos%2Ffreak-mri-accident-worst-ways-to-die%2F688955358391007%2F&psig=AOvVaw3a_1EqDAf-y3o5hn3E8mjv&ust=1632852802350000&source=images&cd=vfe&ved=2ahUKEwi4m6fr4J_zAhUFexoKHb4KAccQr4kDegUIARCQAg

Other Modalities of neurovasculature imaging will be discussed later

- Modalities of imaging to study neurovasculature:
- MRA
- CTA
- DSA
- Doppler ULTRASOUND(Transcranial /NECk)
- MRV
- CTV

IMAGE ORIENTATION

Axial CT

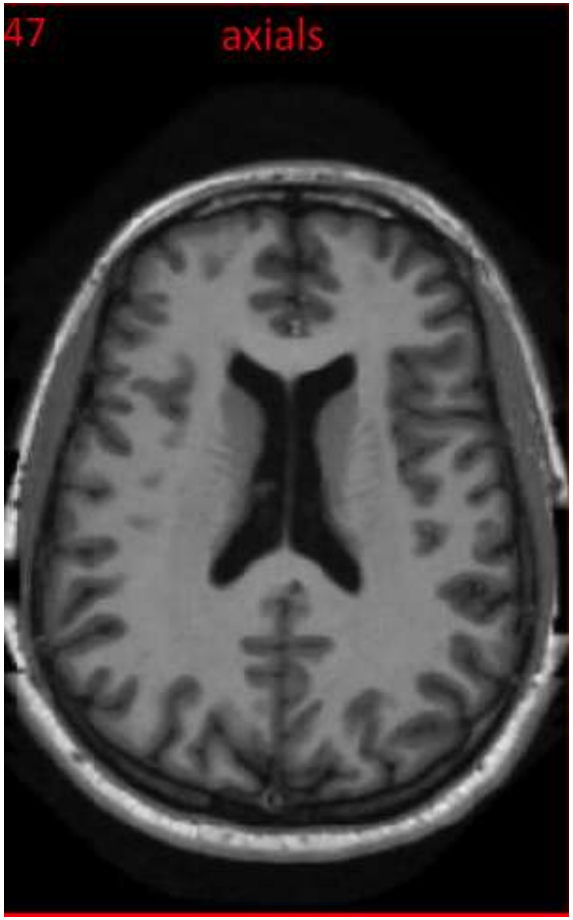
Anterior

Rt

Lt

Posterior

Image Orientation
Axial MRI



Rt

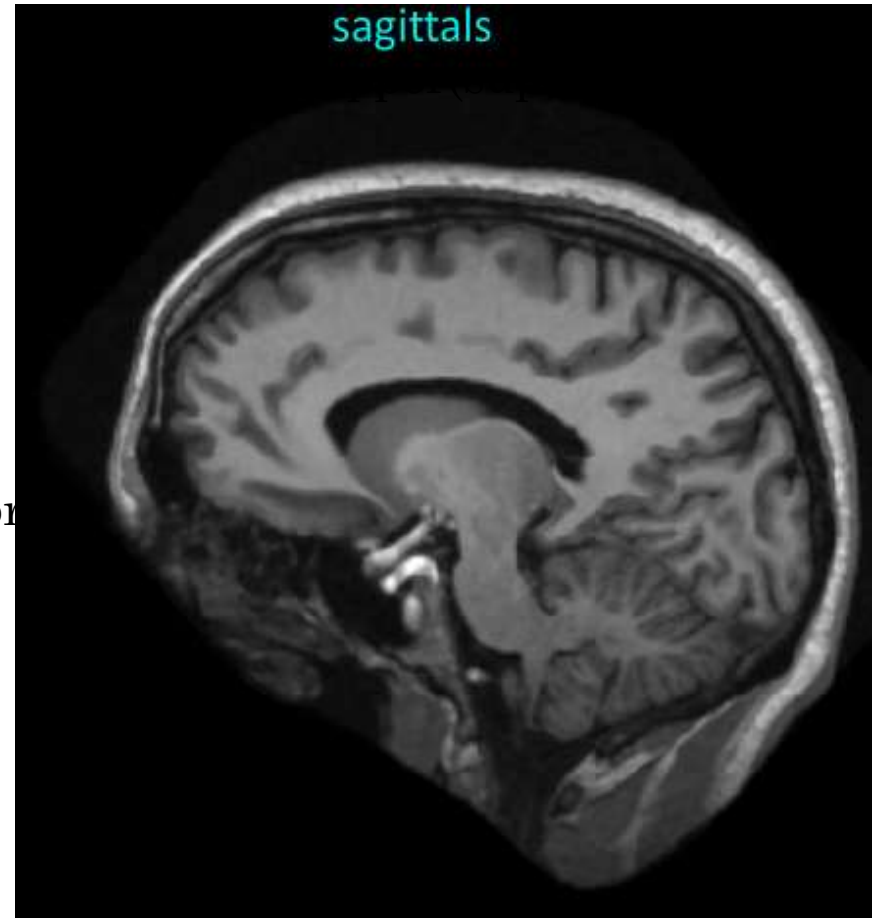
Lt

Posterior

- Superior and inferior levels in axial scanning obtained by changing the slides ups and down

Image Orientation Sagittal MRI

anterior

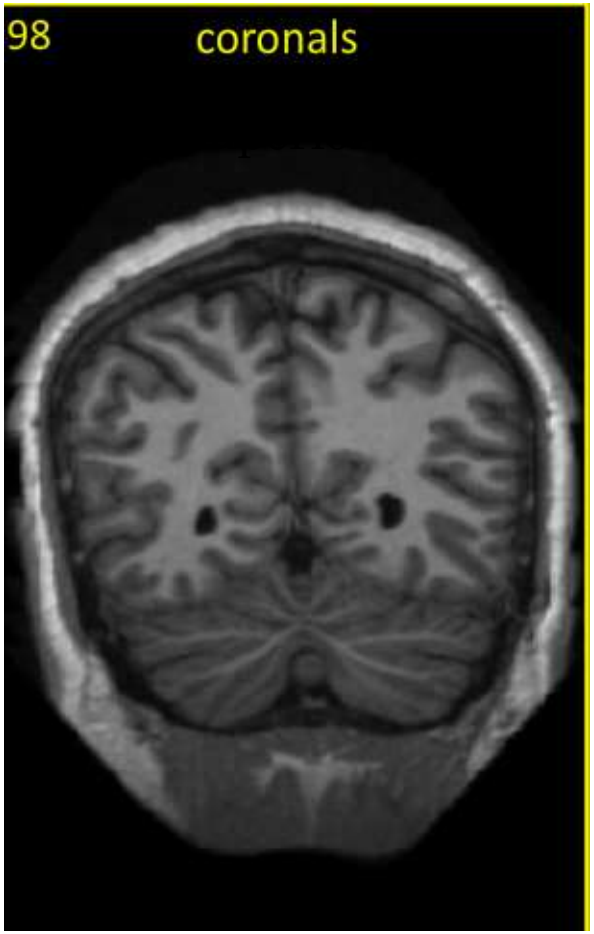


Posterior

Lower

- RT and left images obtained by moving scanned slides to the Rt and Lt .

Image Orientation
Coronal MRI

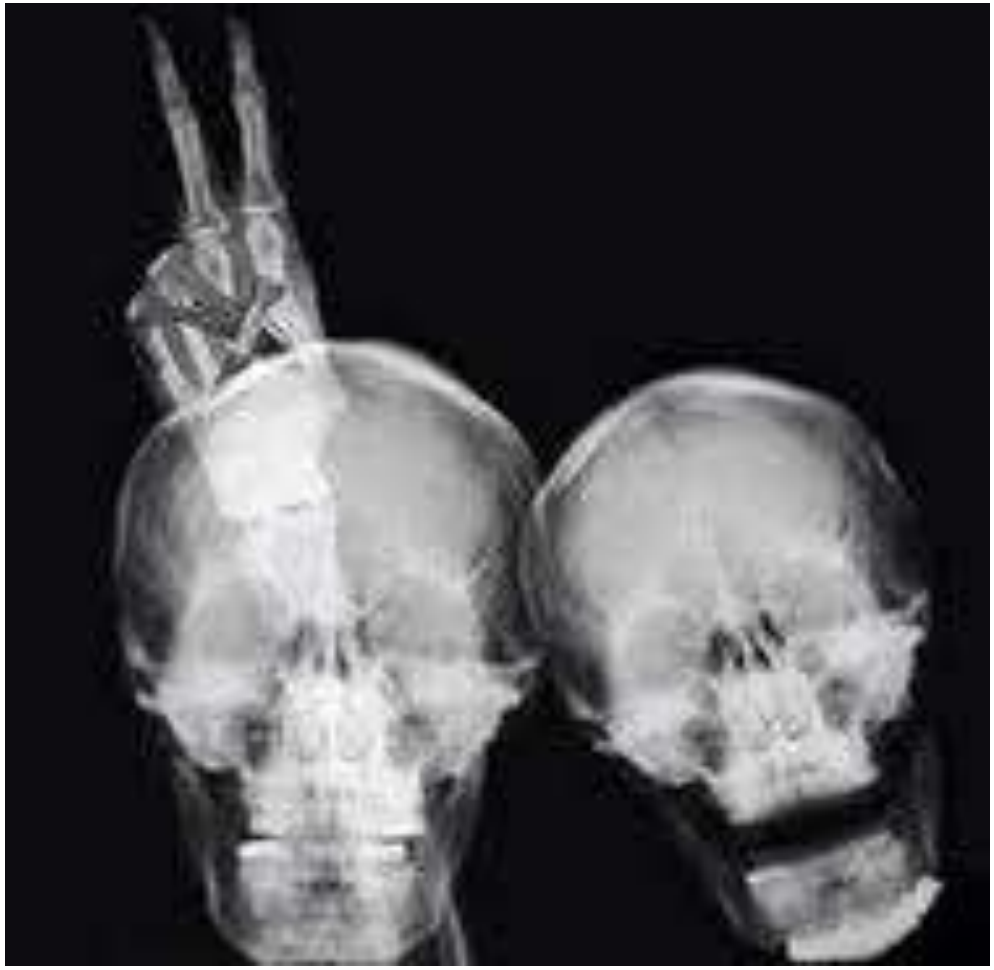


Rt

Lt

Inferior

- Anterior and posterior images obtained by changing the the scanned images from anterior to posterior



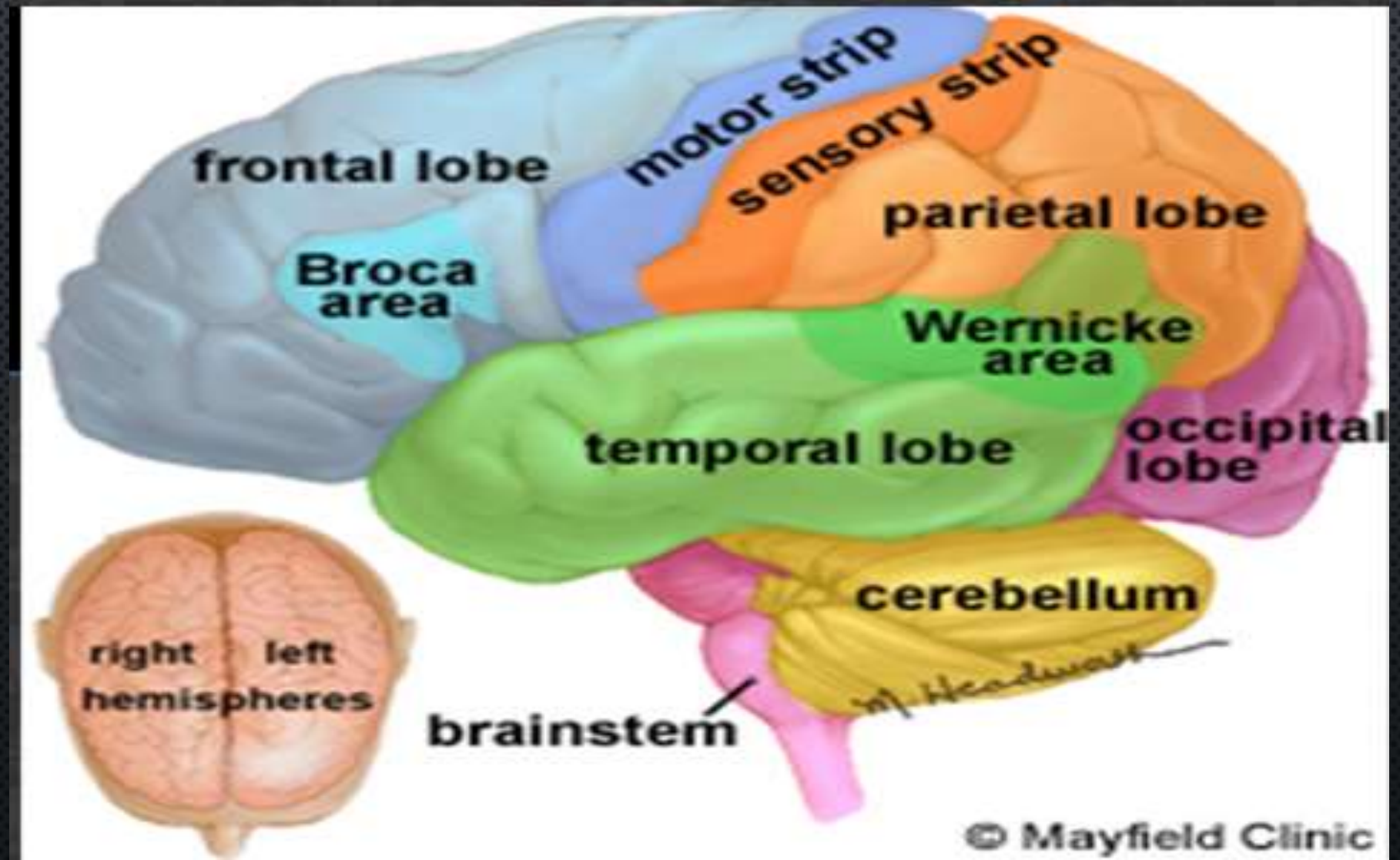
NEUROANATOMY
D.HANA QUDSIEH
NEURORADIOLOGY

2022-2023

BASIC NEUROANATOMY

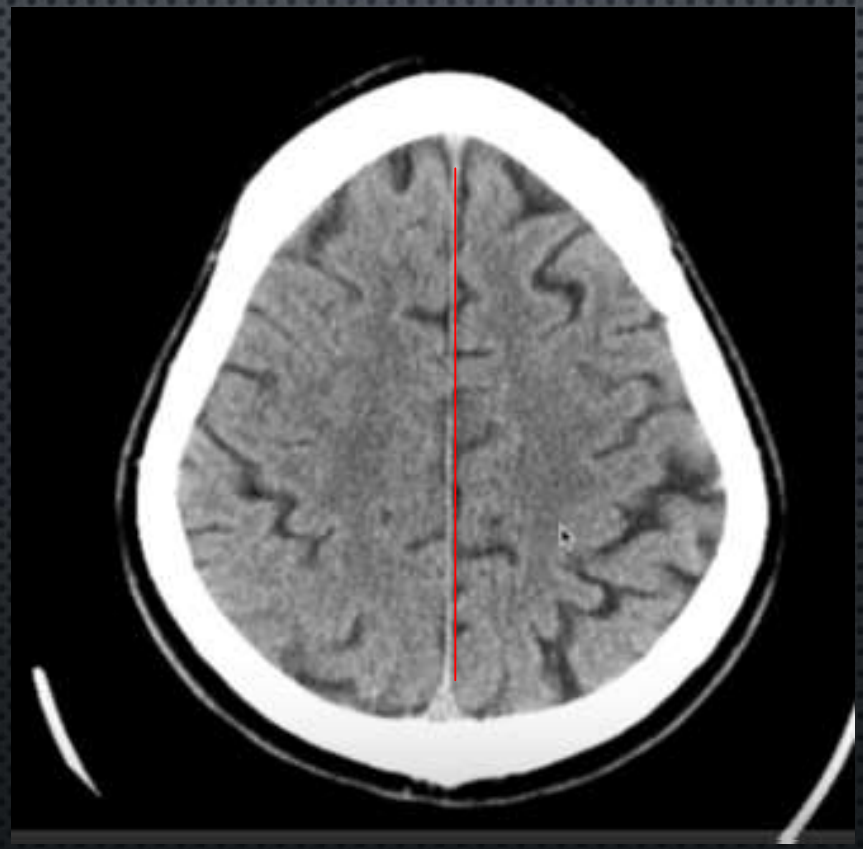
- TEXT REFERANCES IMPORTANT :
- RADIOLOGY CAFÉ /MEDICAL STUDENTS
- RADIOLOGY BASICS E LEARNING

BASIC ANATOMY



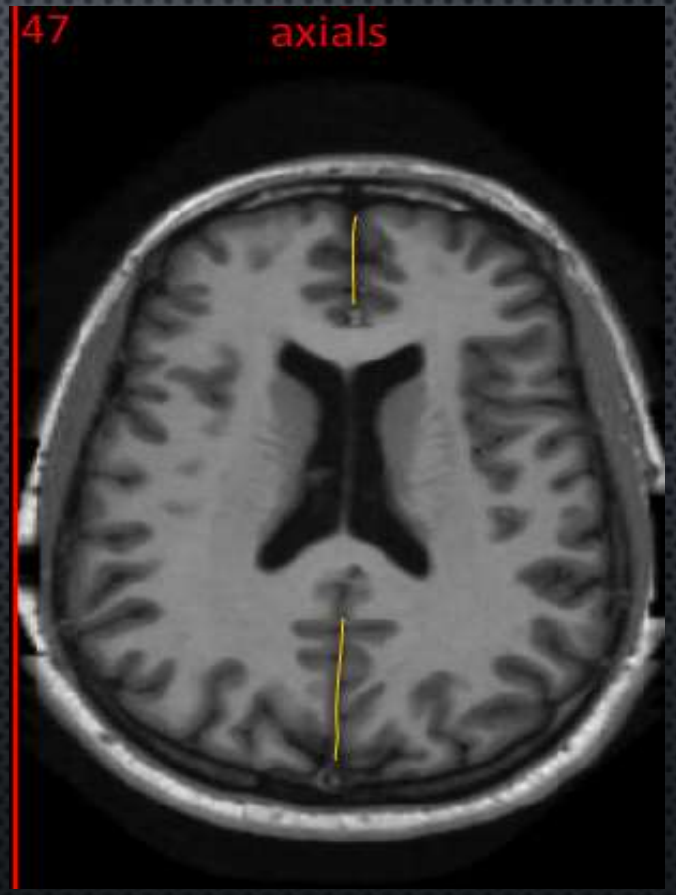
(CT) AXIAL :TWO HEMISPHERES FALX CEREBRI

Rt



Lt

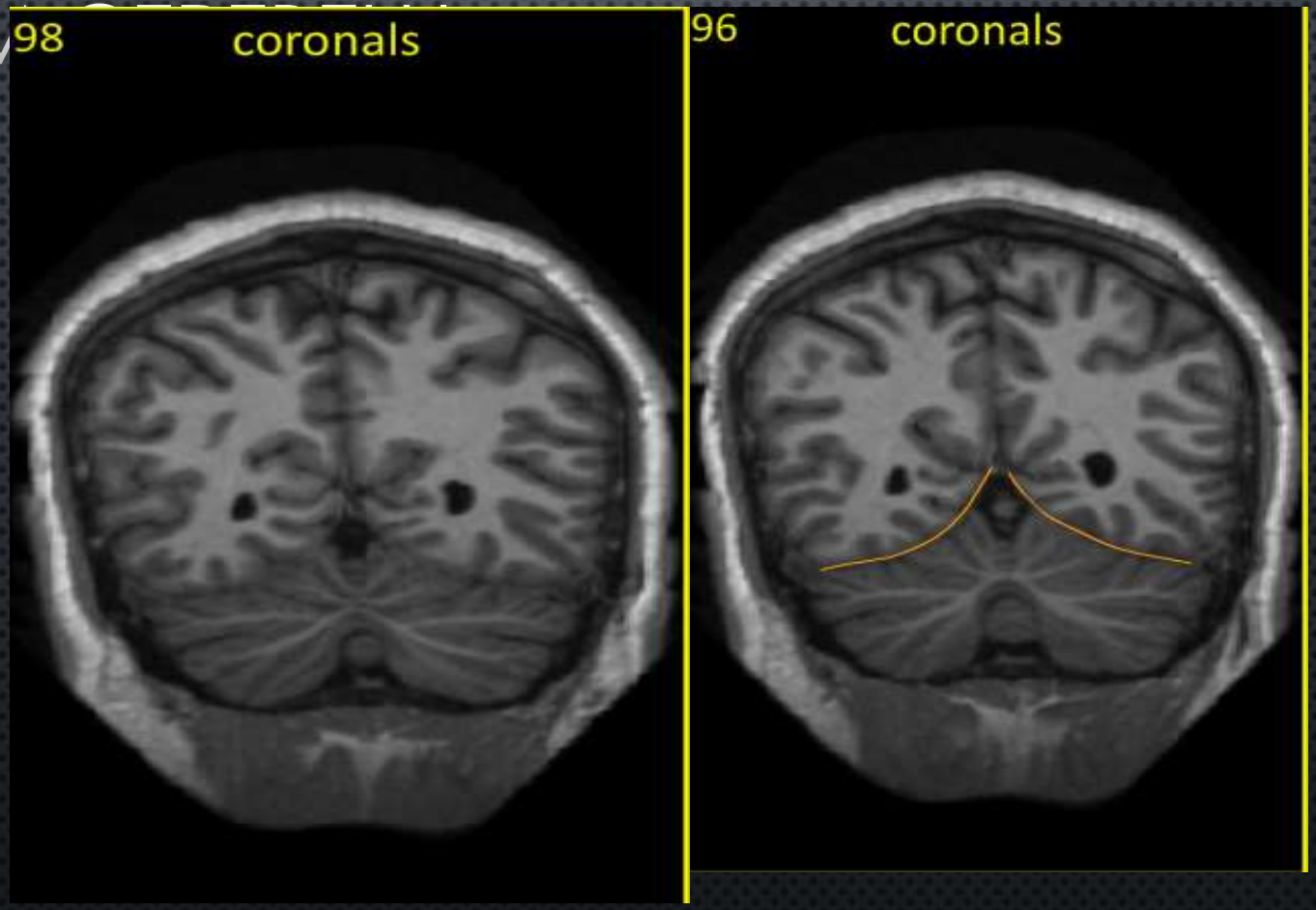
(MRI)
TWO HEMISPHERES
FALX CEREBRI



CT (AXIAL)
TENTORUIM CEREBELLI

(MRI) TENTORUIM

- SUPRATENTORUIM
- INFRATENTORUIM

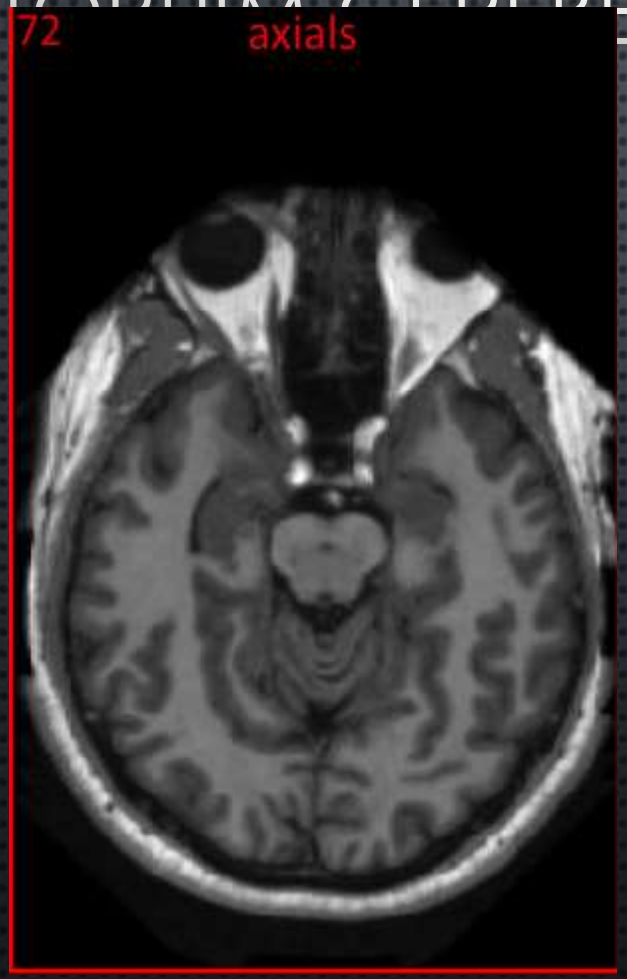


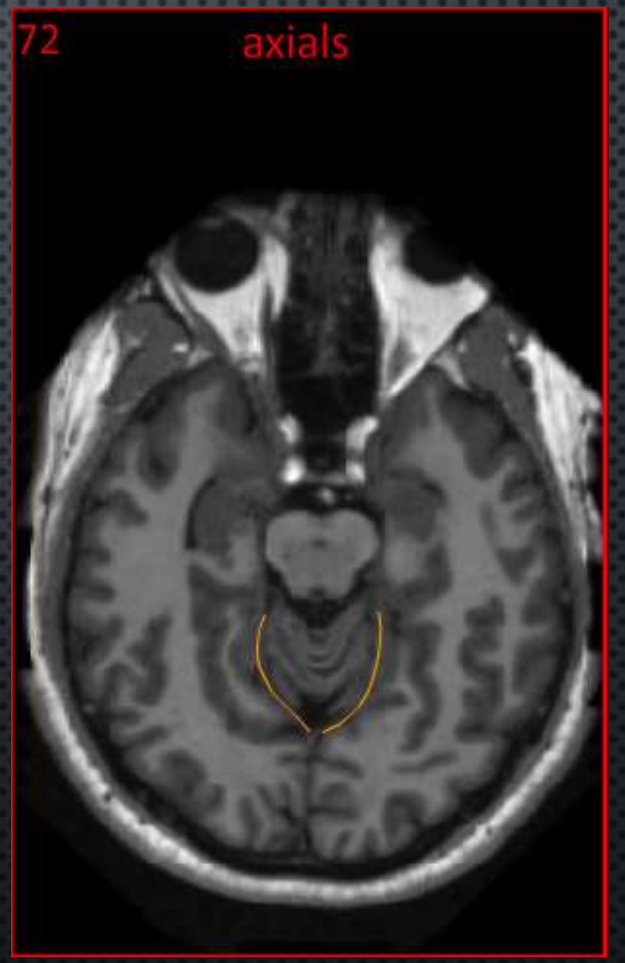
SAGITTAL MRI TENTORUIM

- SUPRA-
- TENTORUIM

- INFRA-
- TENTORUIM

TENTORIUM CEREBELLI

- 



SULCI & GYRI

SULCI

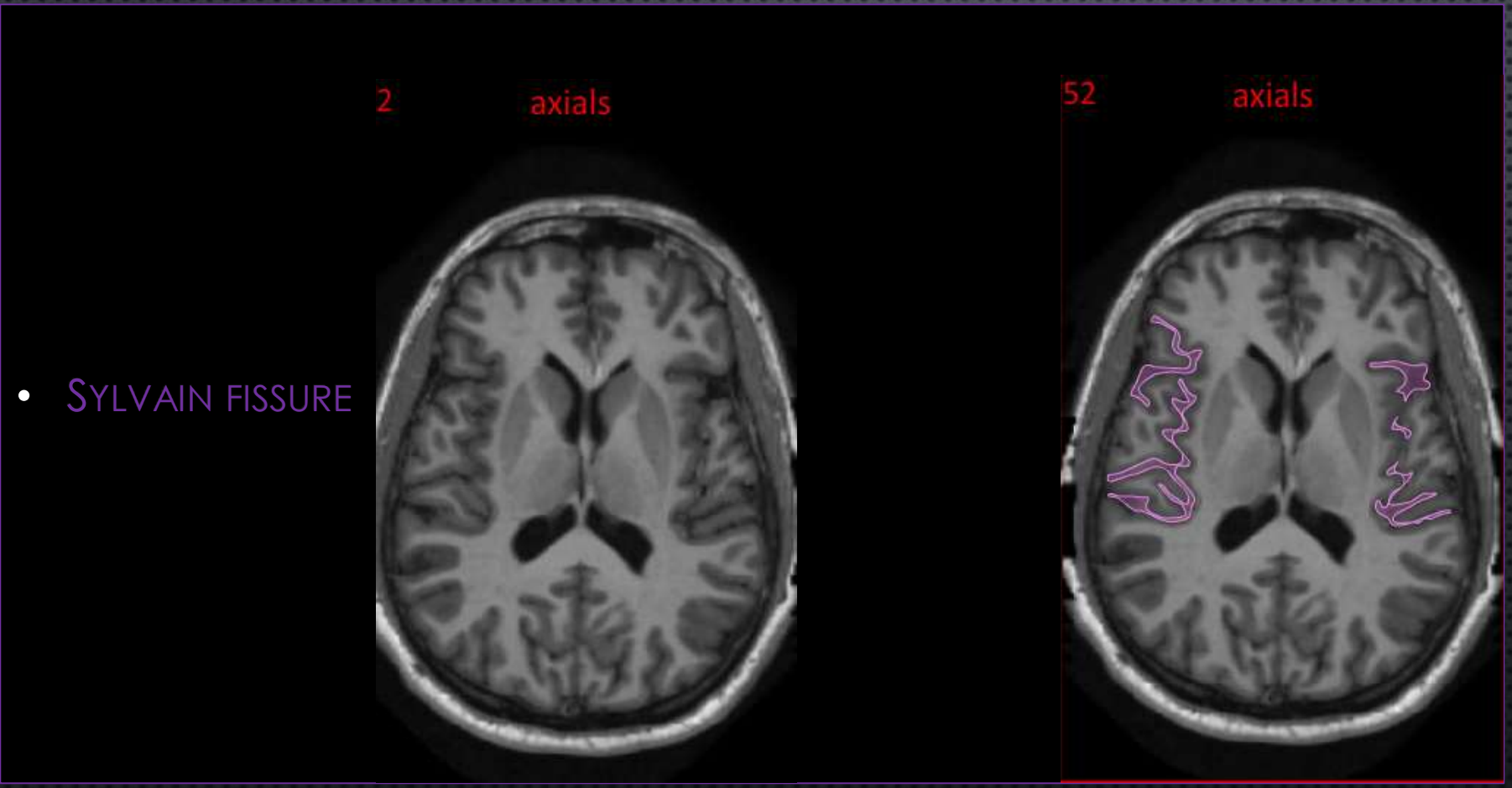
- 1-sylvian fissure(lateral sulcus)
- 2-central sulcus(Rolando)
- 3-Parieto-Occipital sulcus.
- 4-calcarin sulcus

SULCI

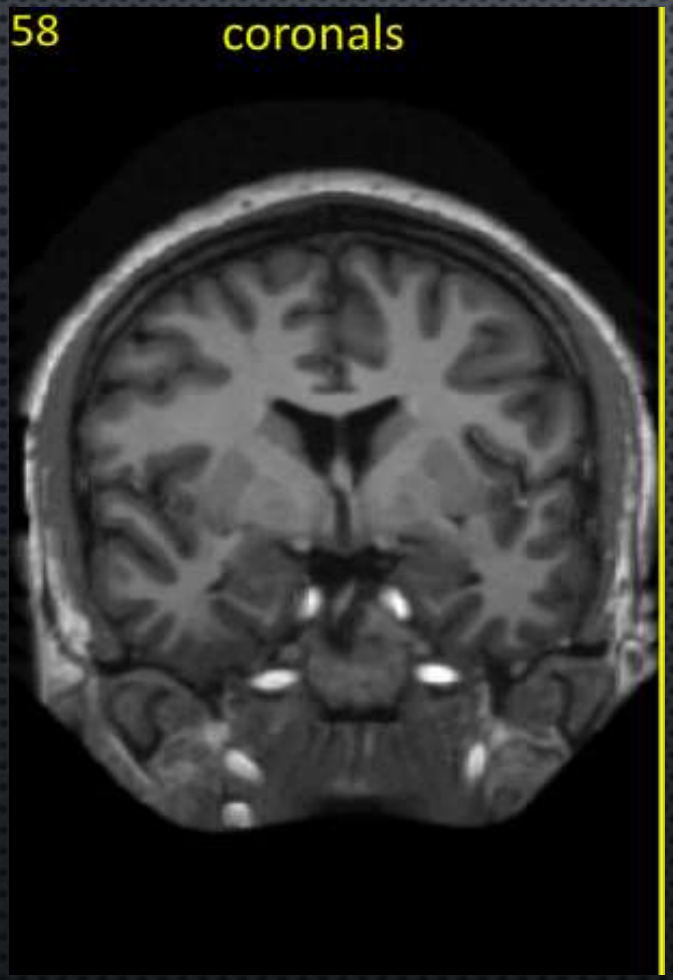
-
- 1-SYLVIAN FISSURE(LATERAL SULCUS): SEPARATE FRONTAL AND TEMPORAL SULCUS
- 2-CENTRAL SULCUS: (OF ROLANDO) :PASS FROM SYLVIAN FISSURE TO SUPERIOR BORDER OF HEMISPHERE SEPARATE FRONTAL FROM PARIETAL LOBE
- 3-PARIETO-OCCIPITAL SULCUS:SEPARATE OCCIPITAL FROM PARIETAL LOBE
- 4-SEPARATE OCCIPITAL FROM TEMPORAL LOBE.
- 5-CINGULATE SULCUS: ABOVE CINGULATE GYRUS.

1.SYLVIAN FISSURE (LATERAL SULCUS)(AXIAL MRI):
SEPARATES FRONTAL AND PARIETAL LOBE ABOVE FROM TEMPORAL LOBE BELOW

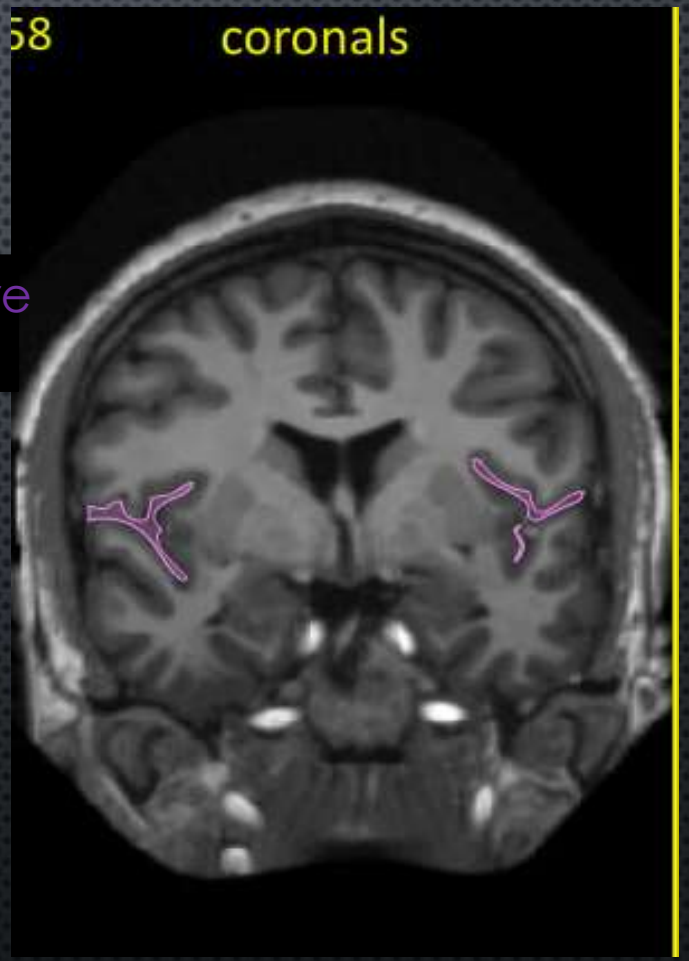
- SYLVAIN FISSURE



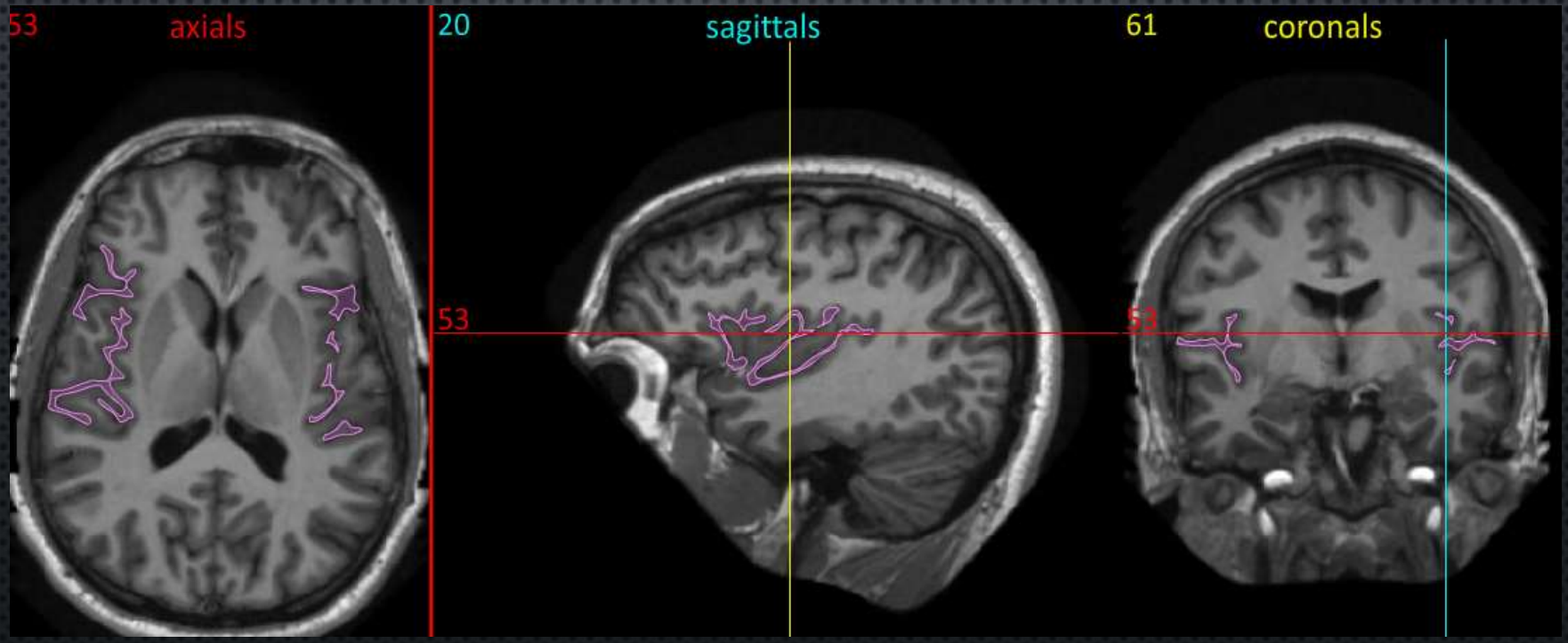
(LATERAL SULCUS)SYLVAIN FISSURE



Sylvain fissure



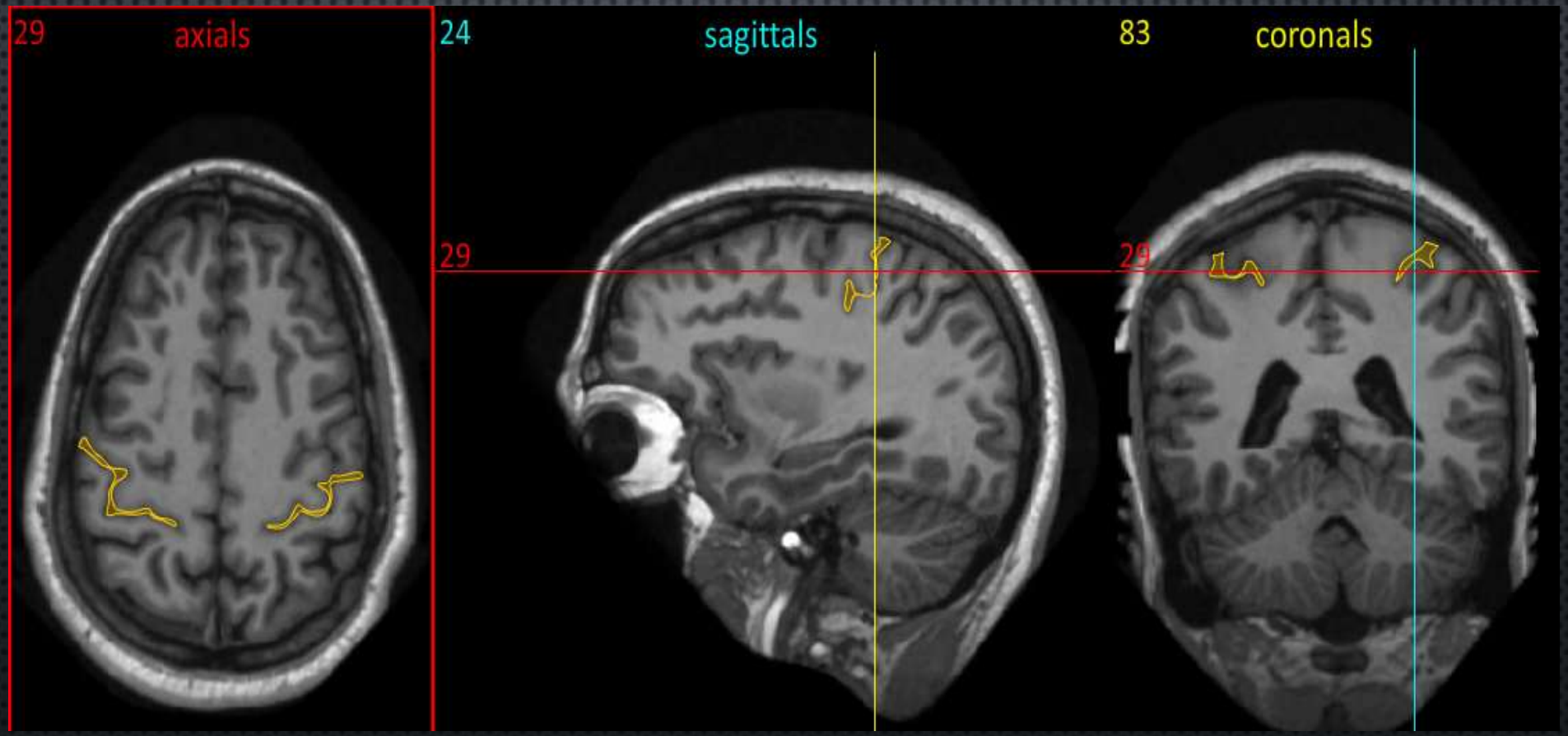
SYLVAIN FISSURE



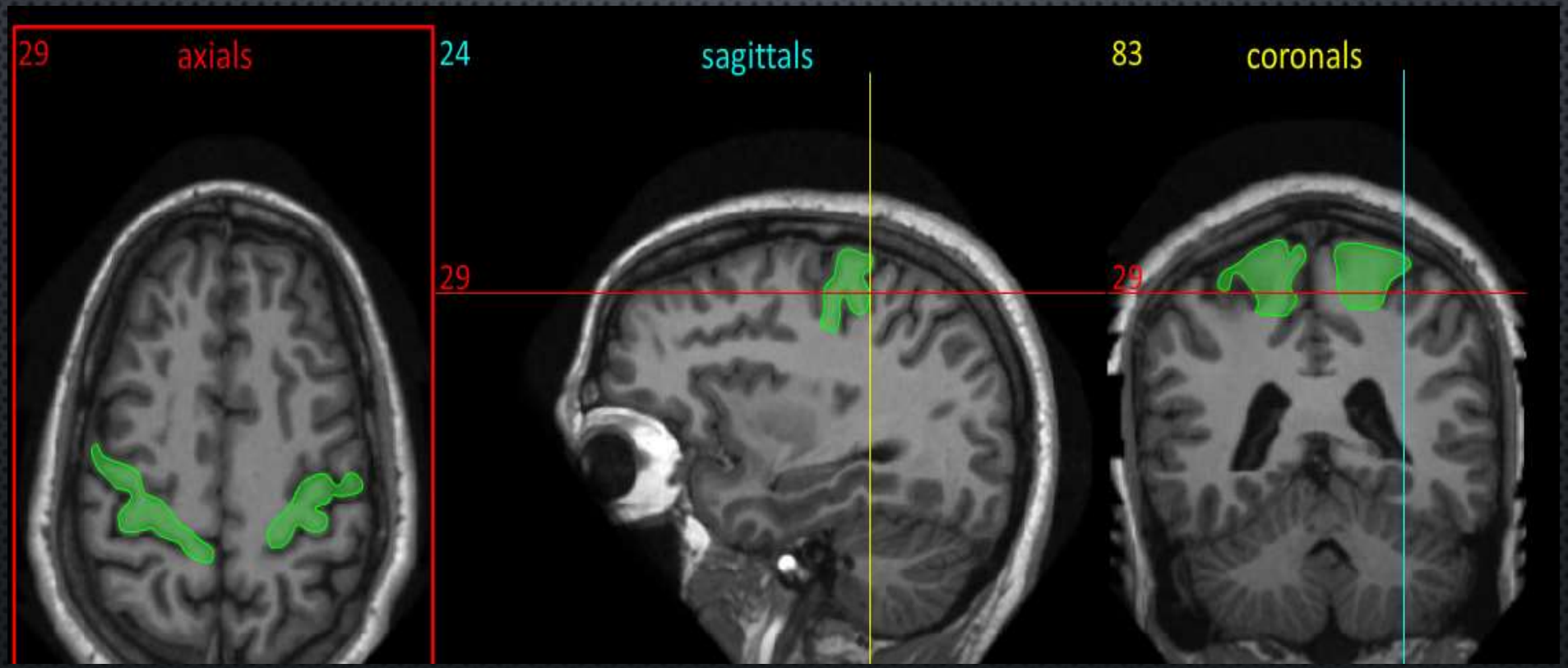
2.CENTRAL SULCUS (SULCUS OF ROLANDO) SEPARATES PARIETAL FROM FRONTAL LOBE.

- CENTRAL
- SULCUS

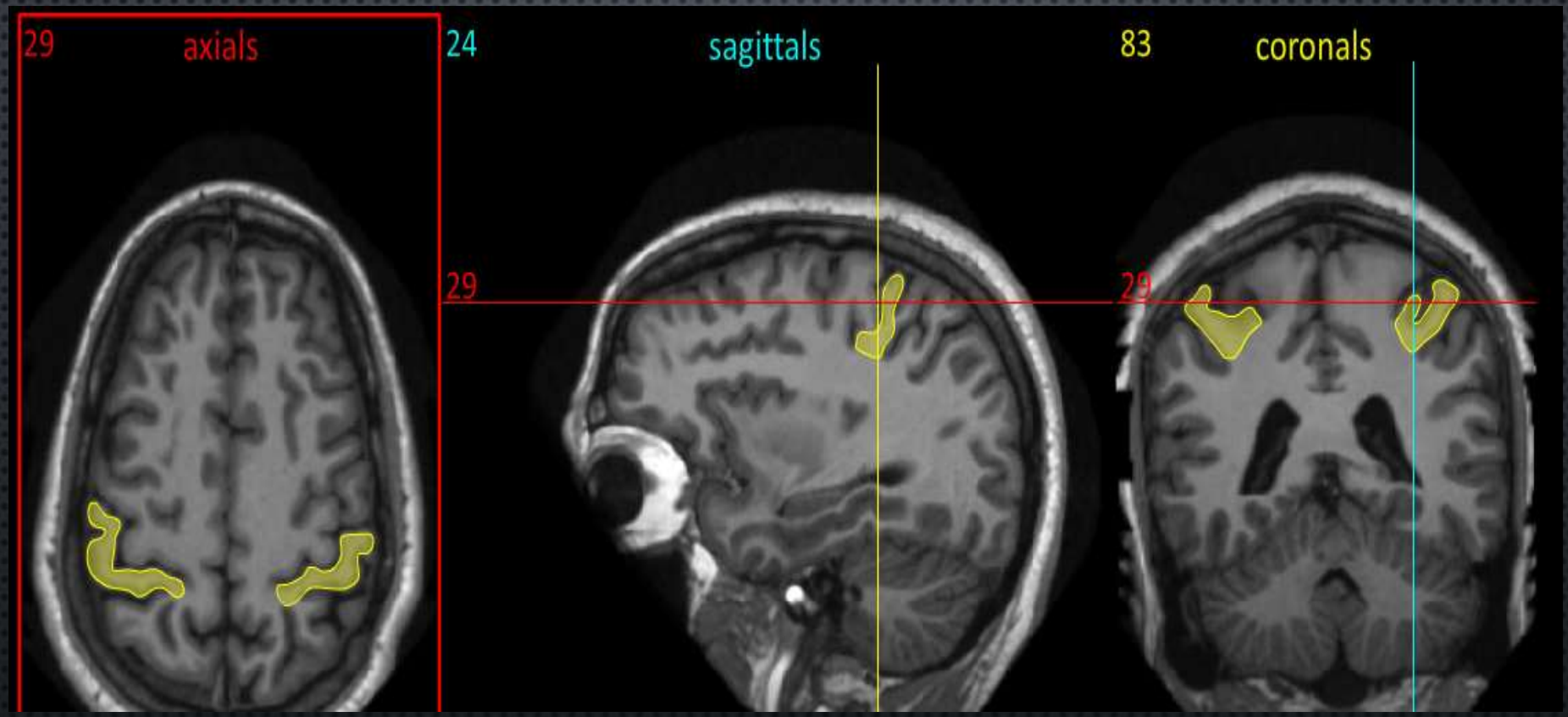
CENTRAL SULCUS



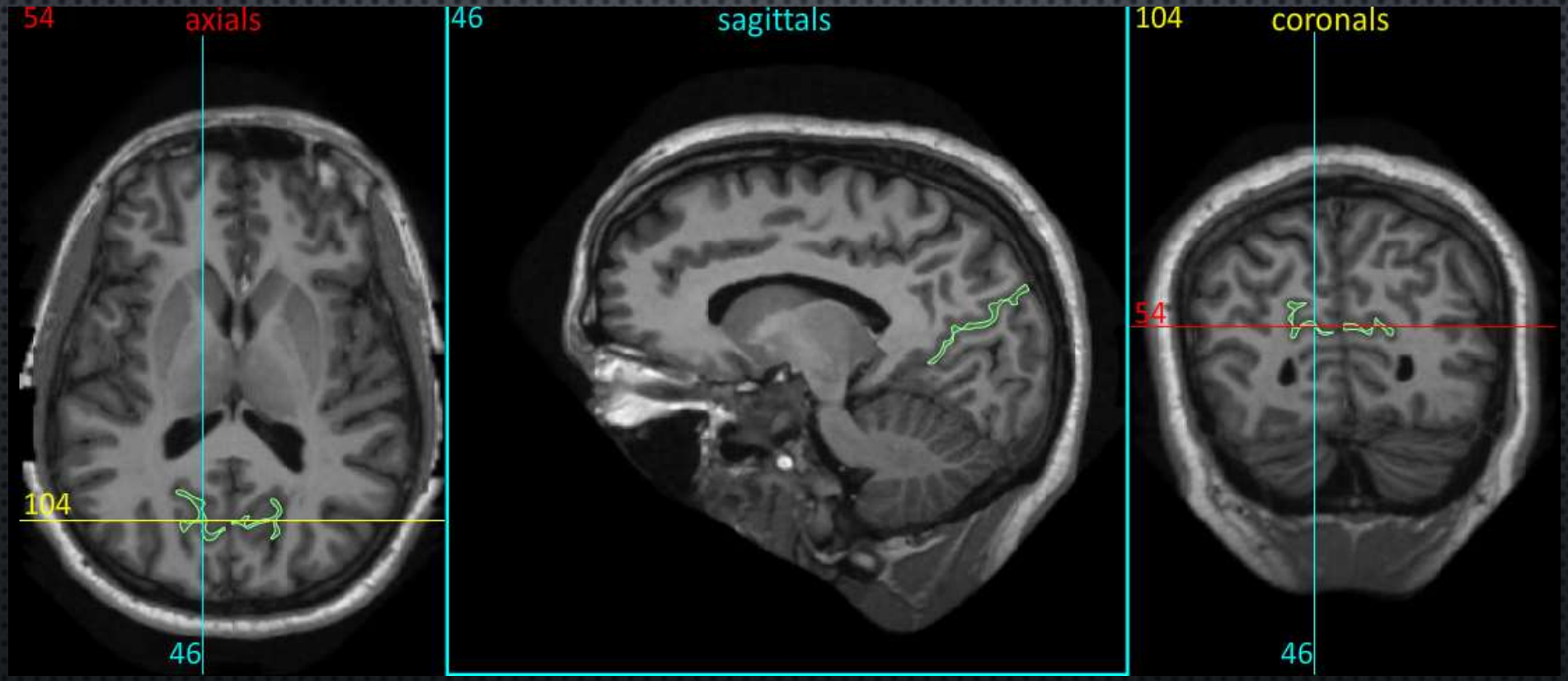
PRECNTRAL GYRUS: ANTERIOT TO CENTRAL GYRUS VOLUNTARY MOTORIC



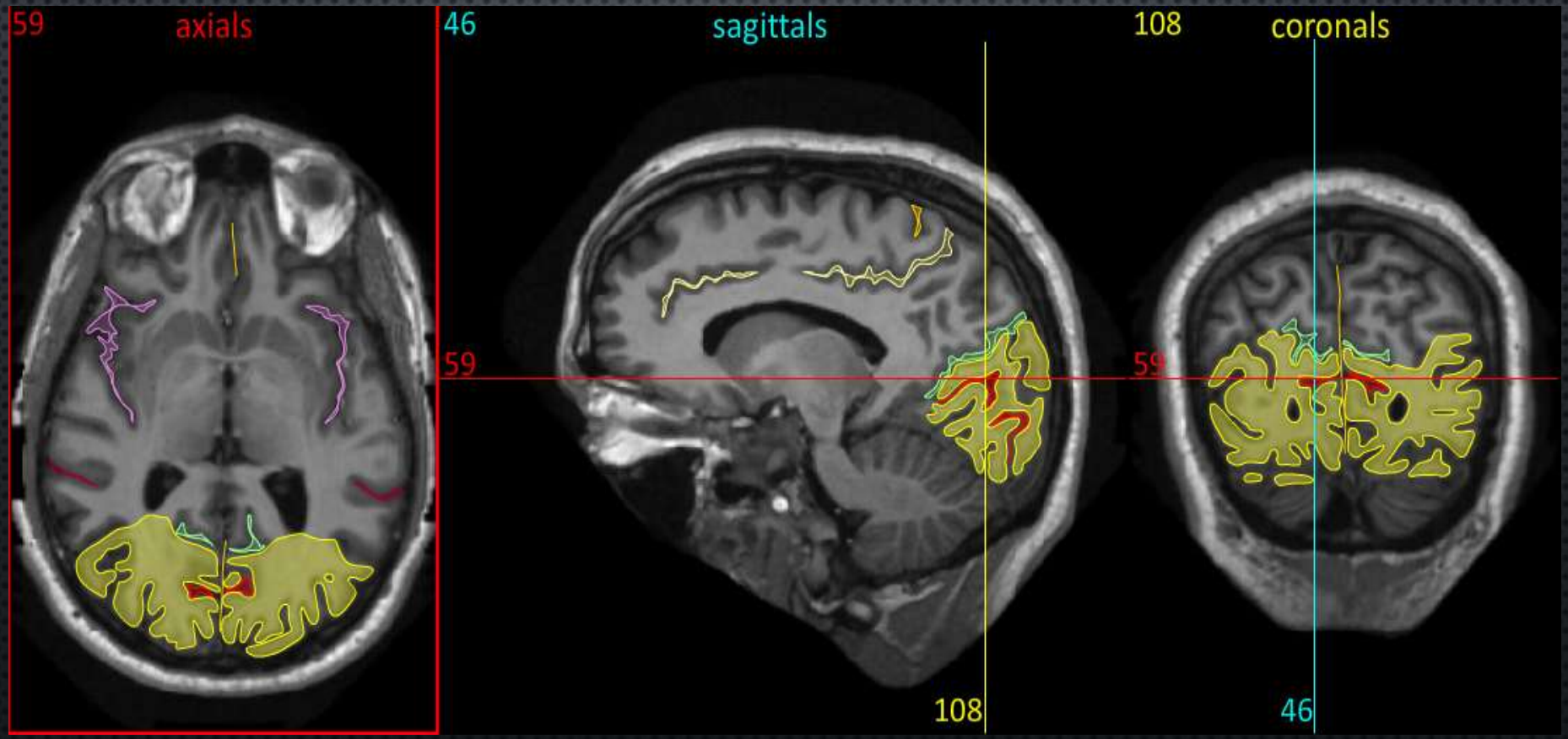
POST CENTRAL GURUS: POSTERIOR TO CENTRAL SULCUS SENSORY



3-PARIETO-OCCIPITAL SULCUS



4.CALCARINE SULCUS(RED) IN OCCIPITAL LOBE CONTAIN THE VISUAL CORTEX RECEIVE STIMULI FROM OPPOSITE HALF FIELD



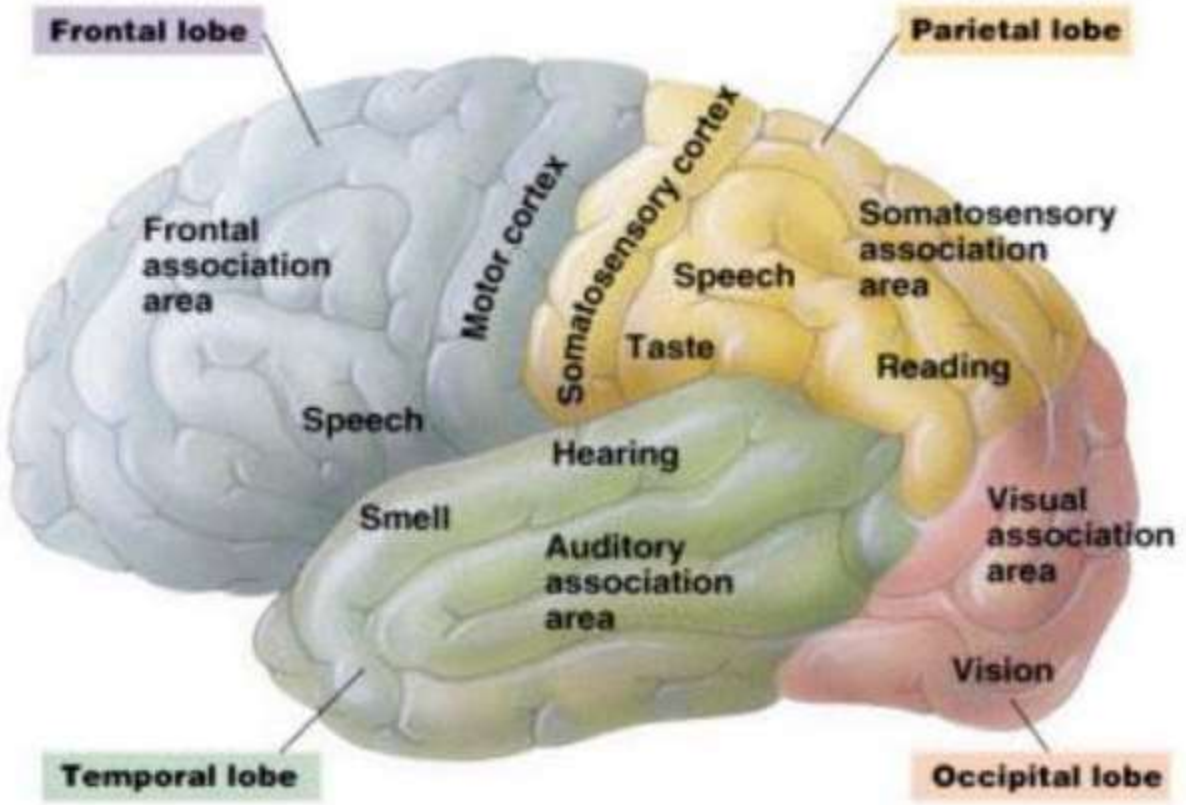
LOBES

LOBES

- 1-FRONTAL LOBE
- 2-PARITAL LOBE
- 3-TEMPORAL LOBE
- 4-INSULAR LOBE
- 5-OCCIPITAL LOBE

LOBES

- Map the functional areas as seen in the diagram below with different colored permanent markers. The brain is both anatomically and functionally segregated. Different function are located in particular regions of each lobe.



- LO
-

FRONTAL

- ANTRIOR TO CENTRAL SULCUS,SUPERIOR TO LLATERAL SULCUS.
- CONTAINS:
- 1-MOTORIC AND PREMOTORIC ARA:CONTROL VOLUNTARY MOVEMENT.
- 2-Pre frontal: mainly intlctual ,behavoiral function.
- 3-BROCA (MOTORIC SPECH ARE) :POSTRIOR INFRIOR TO PRE CENTRAL AREA.

PARIETAL

- Posterior to central sulcus and superior to lateral sulcus.
- Contains:
- 1-post central gyrus: sensory cortx
- 2-parietal association cortex:postrior to sensory area

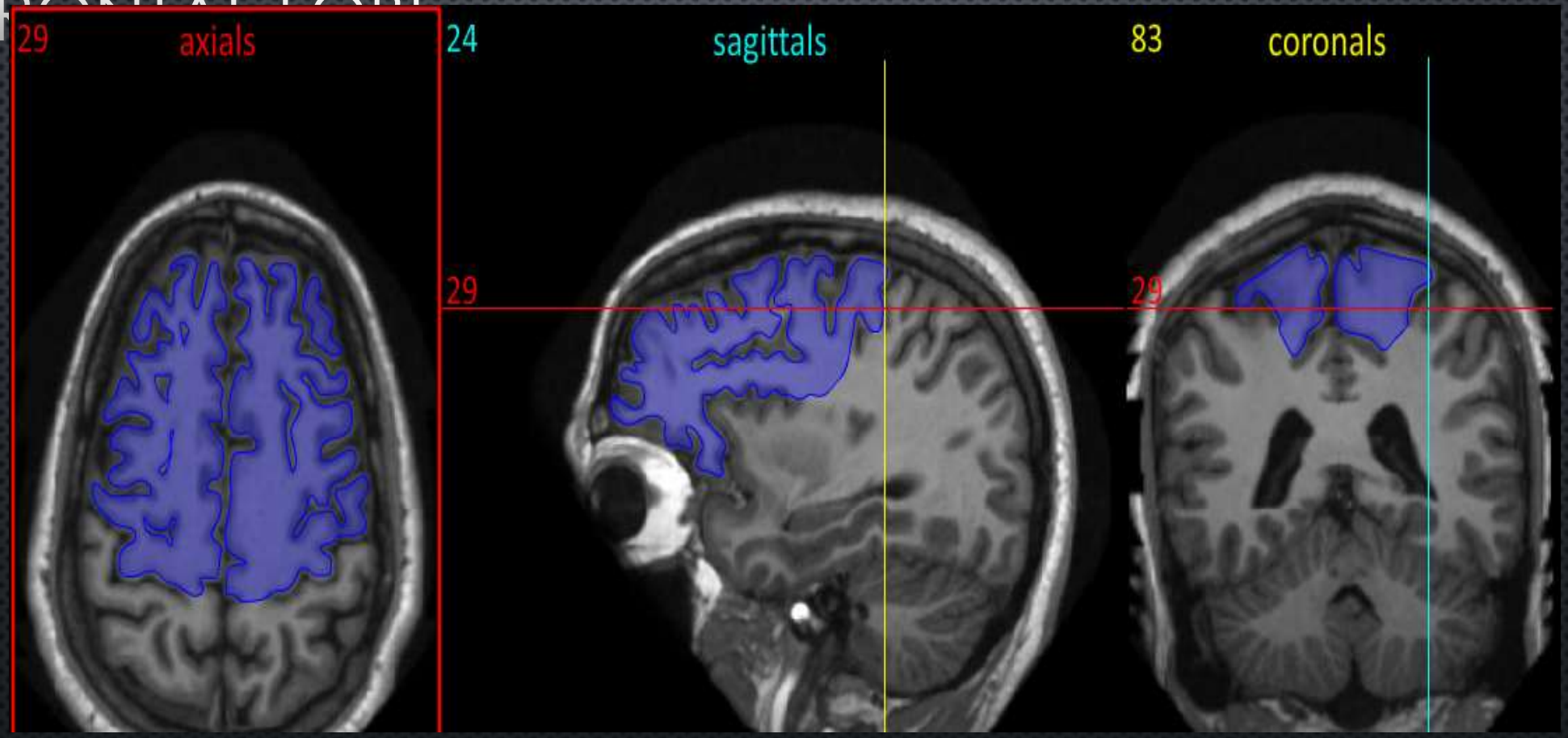
OCCIPITAL

- POSTRIOR TO PARIETAL AND TEMPORAL LOBE ,SEPERATED FROM PARIETAL LOBE MEDIALLY BY PARIETO OCCIPITAL SULCUS AND FROM TEMPORAL LOBE BY CALCARINE SULCUS.
- CONTAINS:VISUAL CORTEX SURROUN THE CALCARINE SULCUS AND RECEIVE STIMULI FROM THE HALF OPPOSITE SIDE.

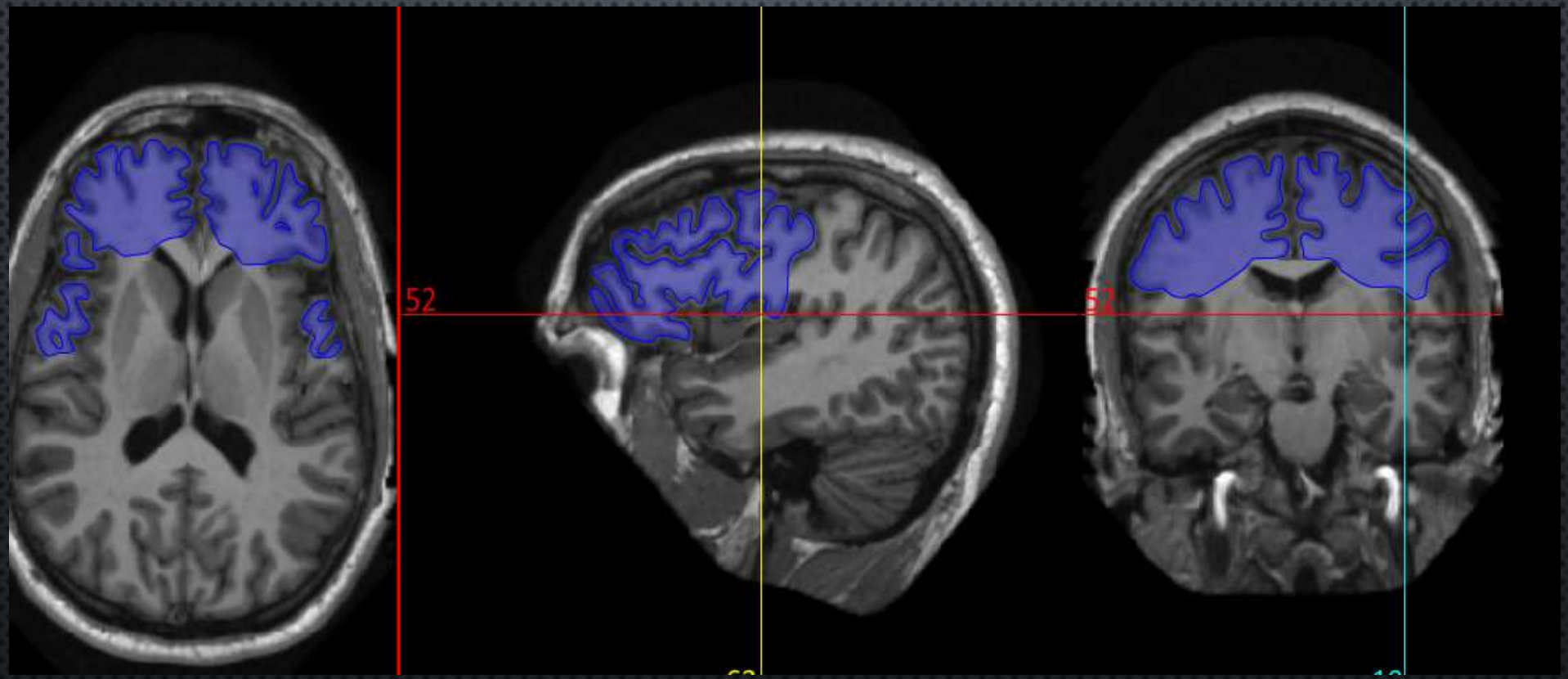
TEMPORAL

INFERIOR TO LATERAL SULCUS ANTERIOR TO OCCIPITAL LOBE HAS THREE GYRI
CONTAINS:
1-AUDITORY CORTEX:SUPRIOR GYRUS(RECEPTION AUDITORY STIMULI
2-TEMPORAL ASSOCIATD CORTEX (RCOGNITION OF AUDITORY STIMULI)

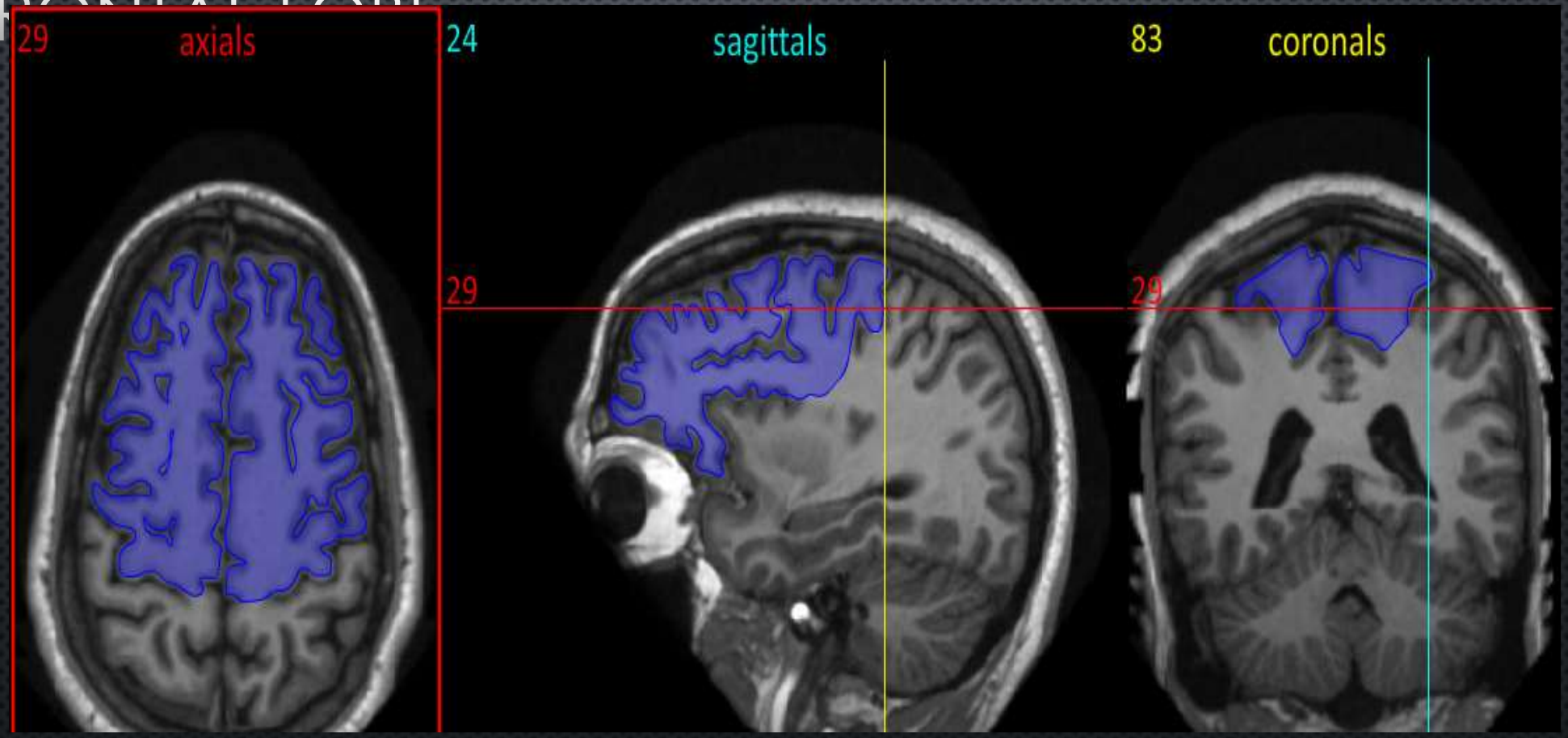
FRONTAL LOBE



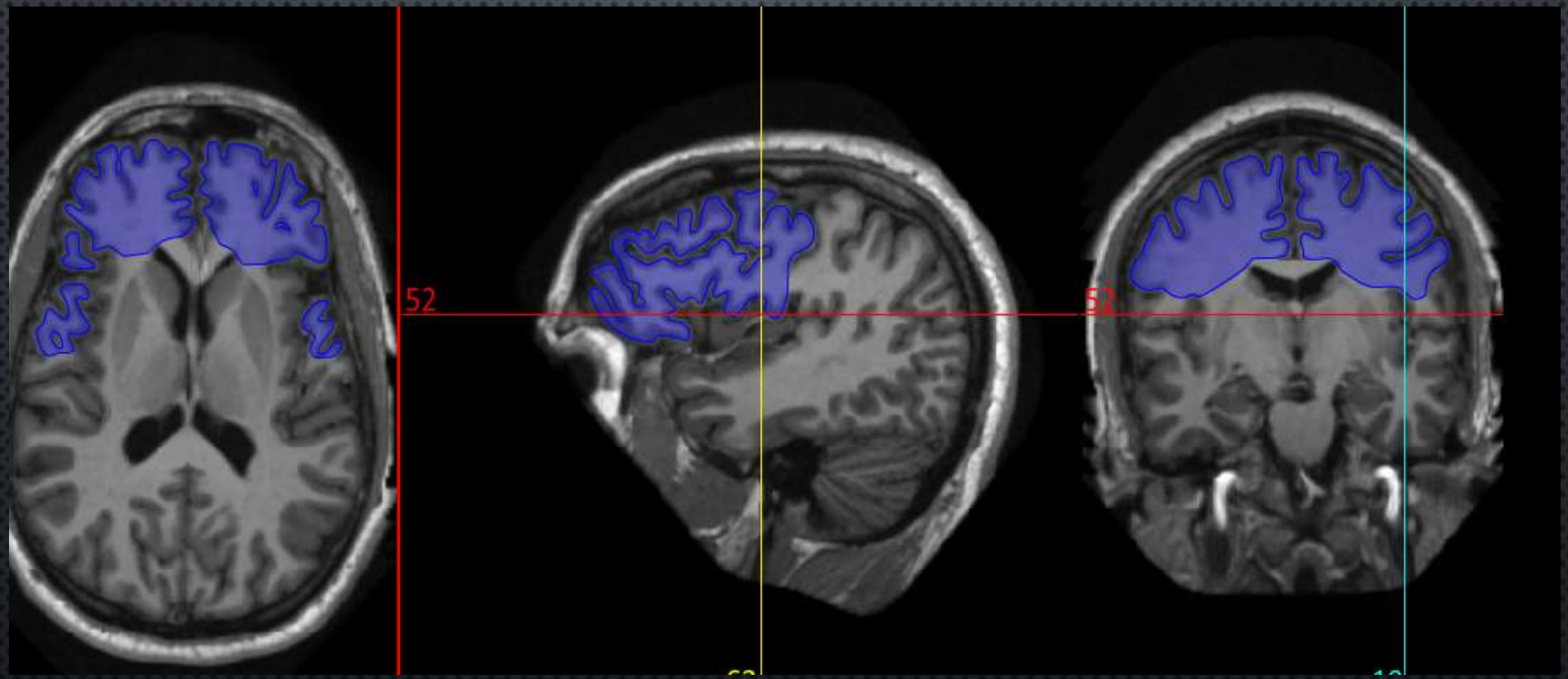
FRONTAL LOBE



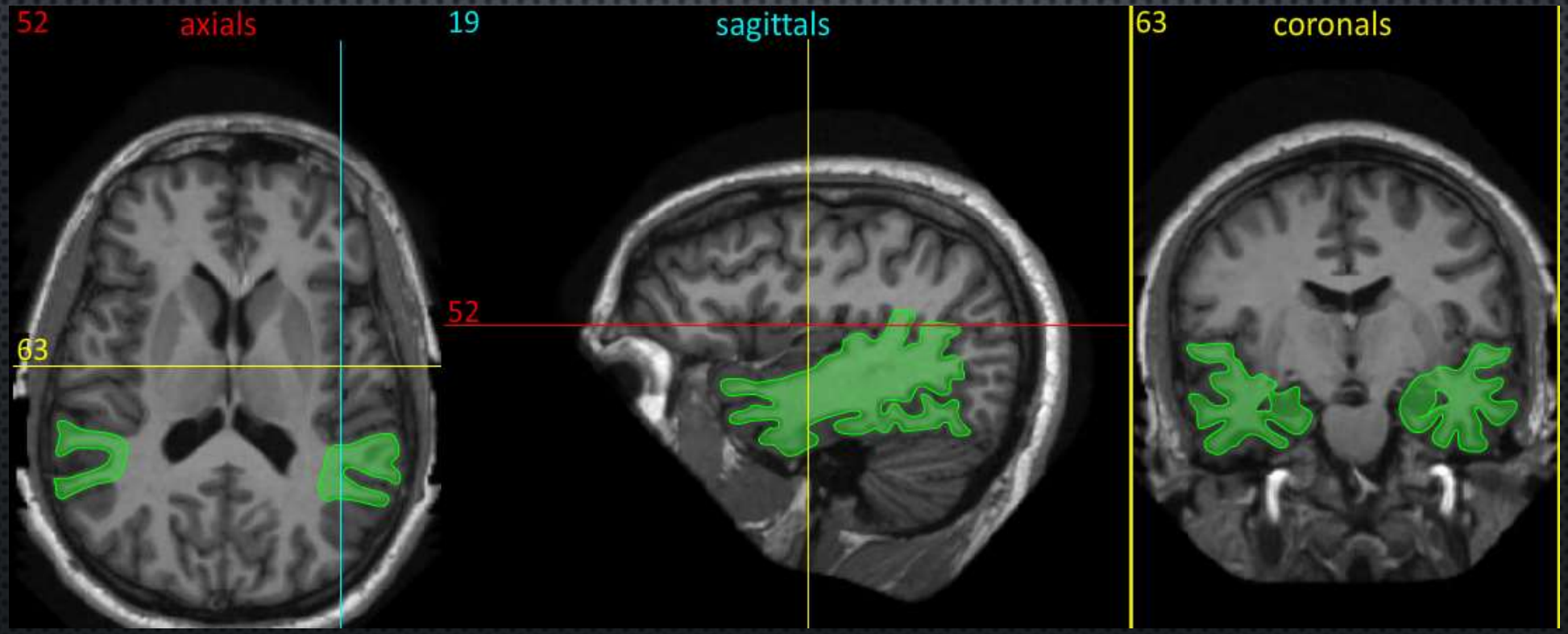
FRONTAL LOBE



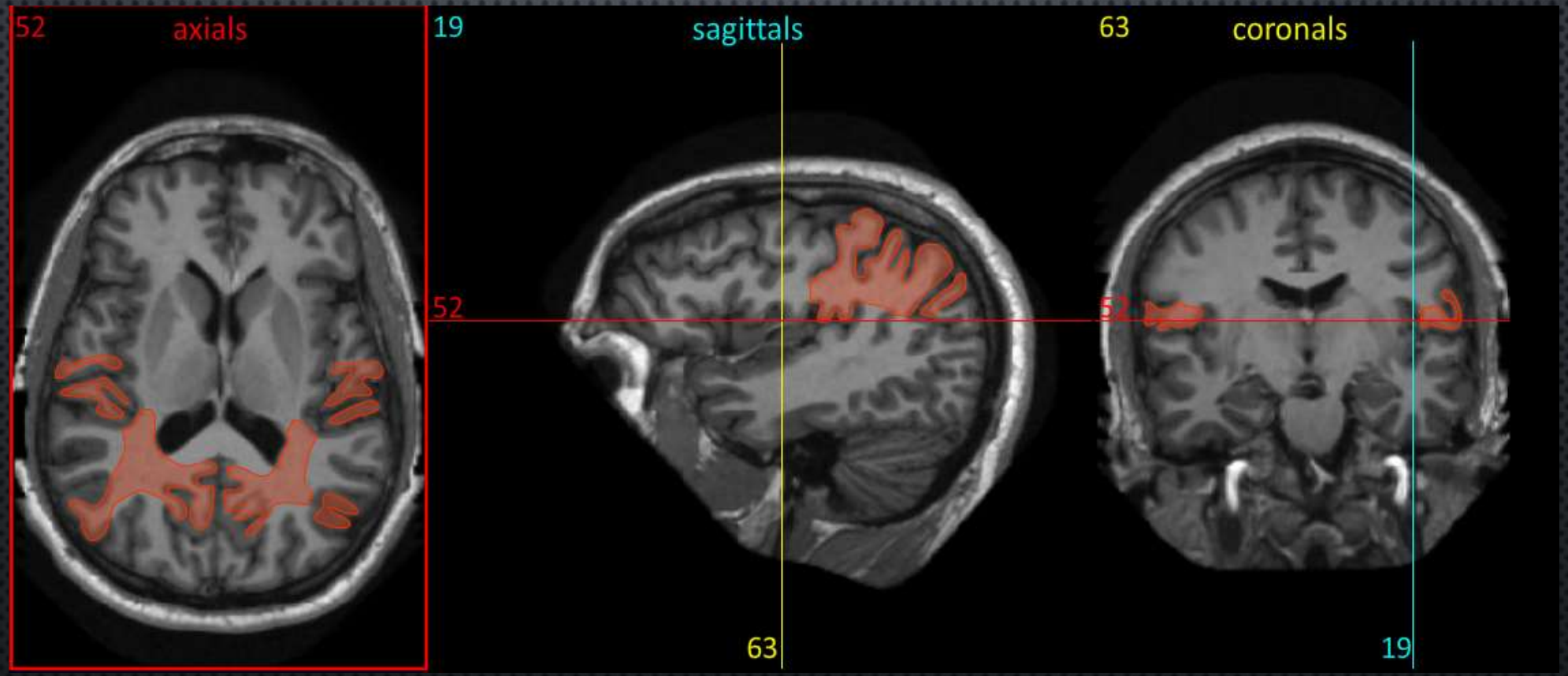
FRONTAL LOBE



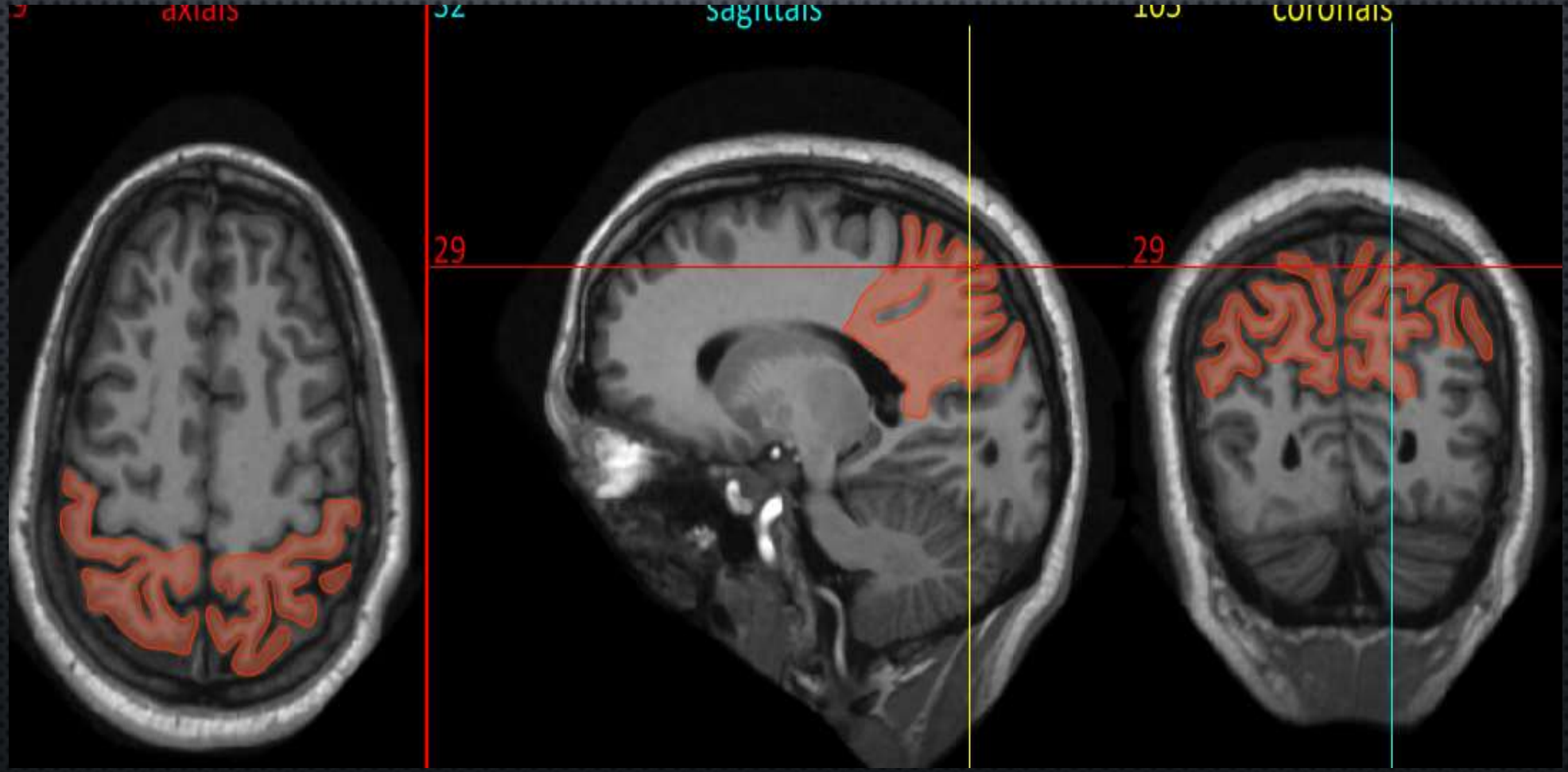
TEMPORAL LOBE



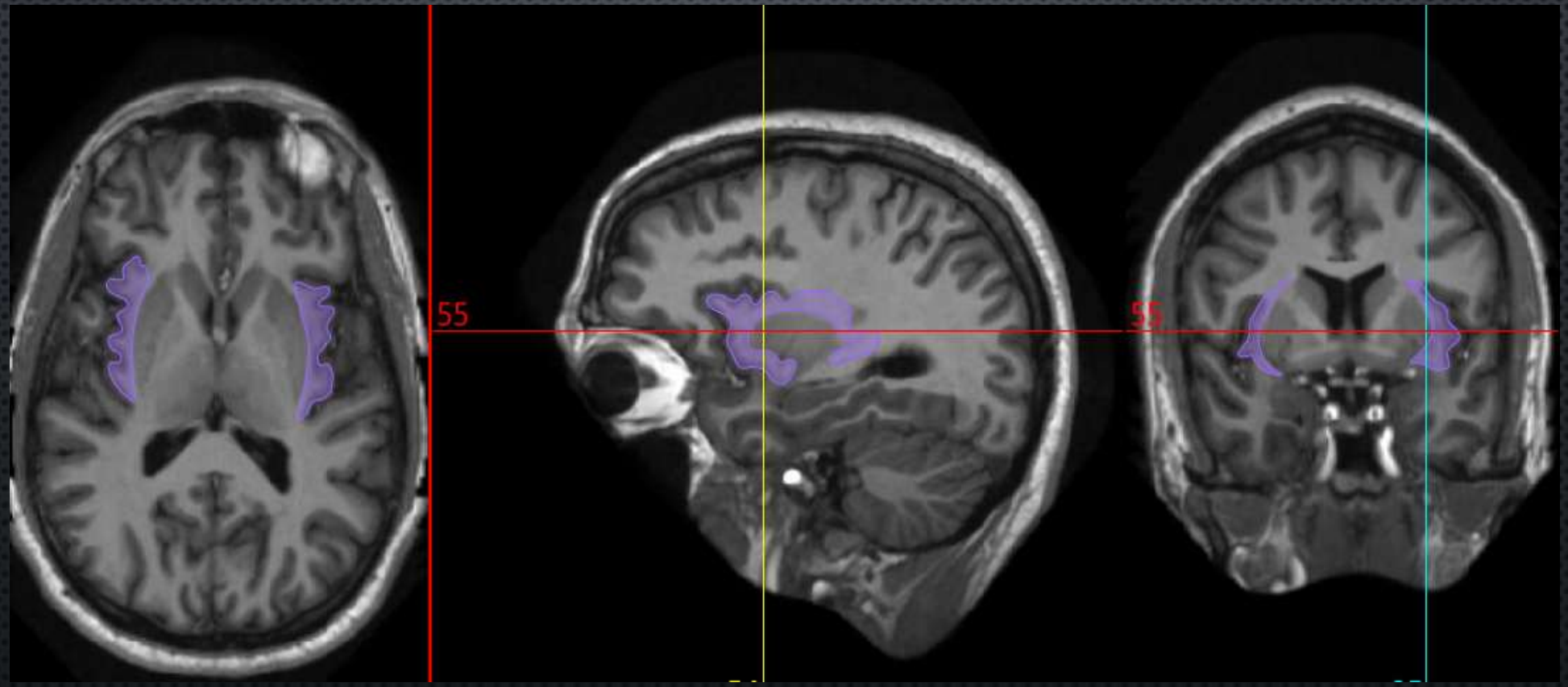
PARIETAL LOBE



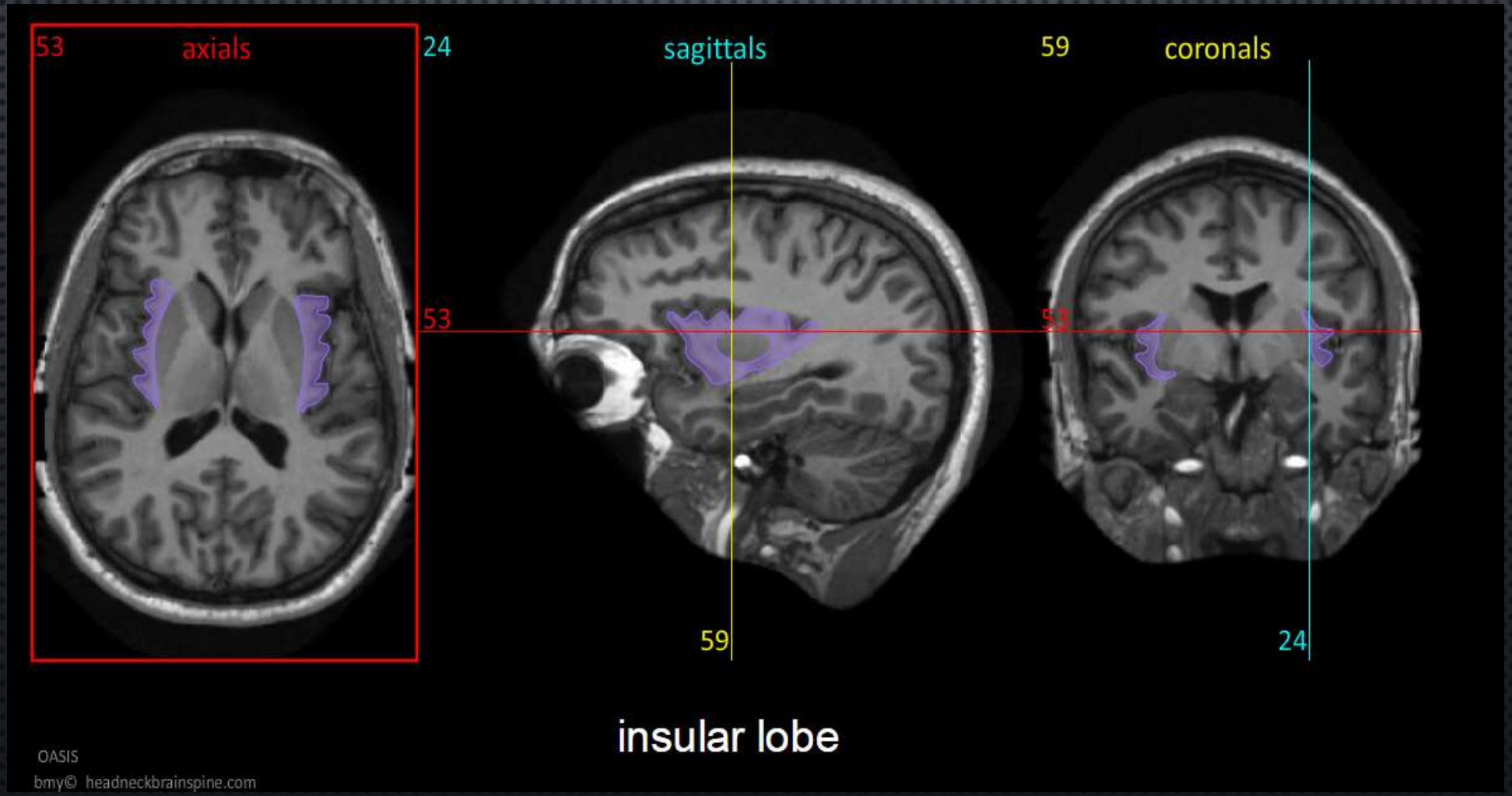
PARIETAL LOBE



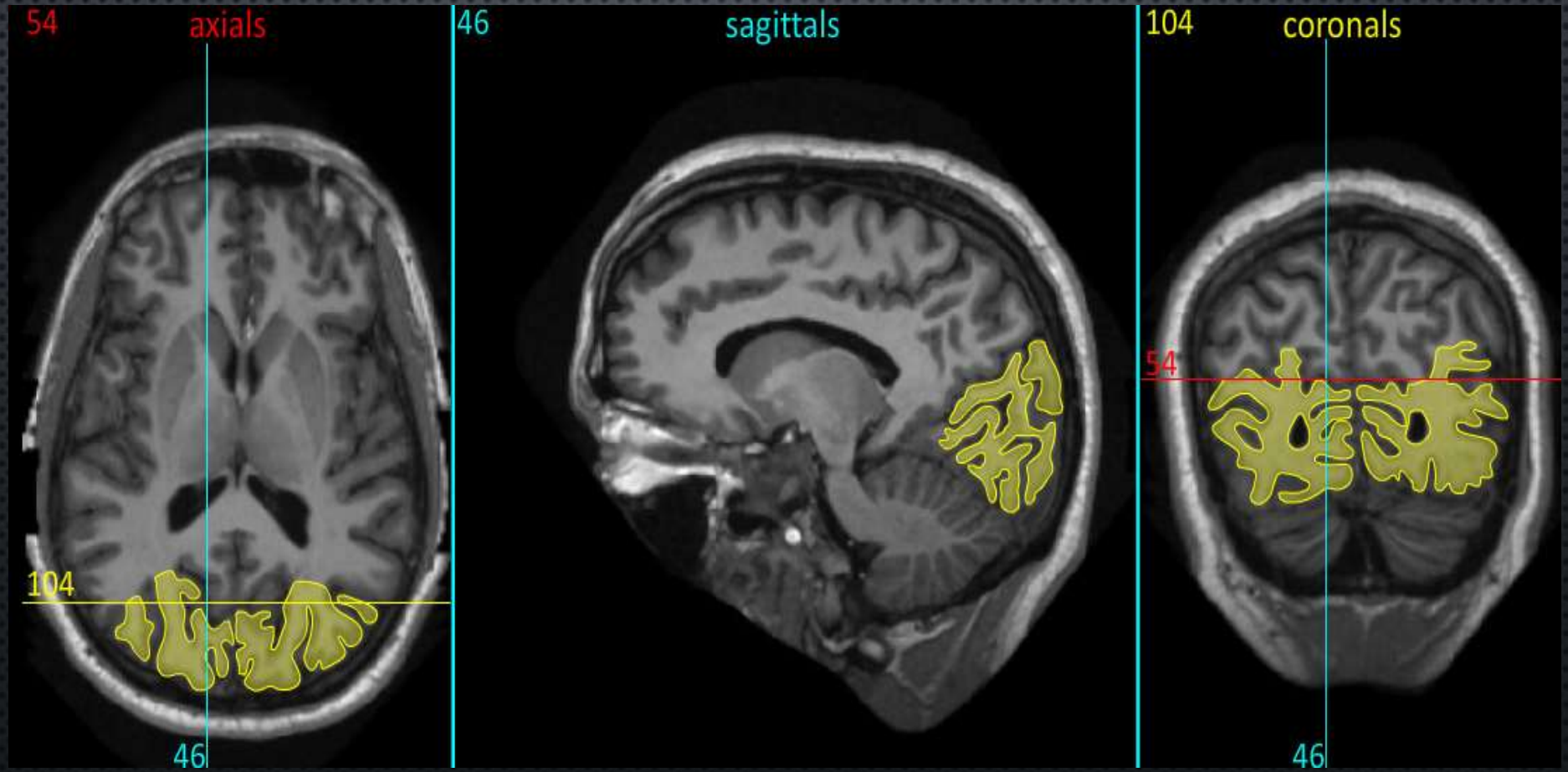
INSULAR LOBE



INSULAR LOBE: GREY MATTER DEEP TO SYLVIAN FISSURE

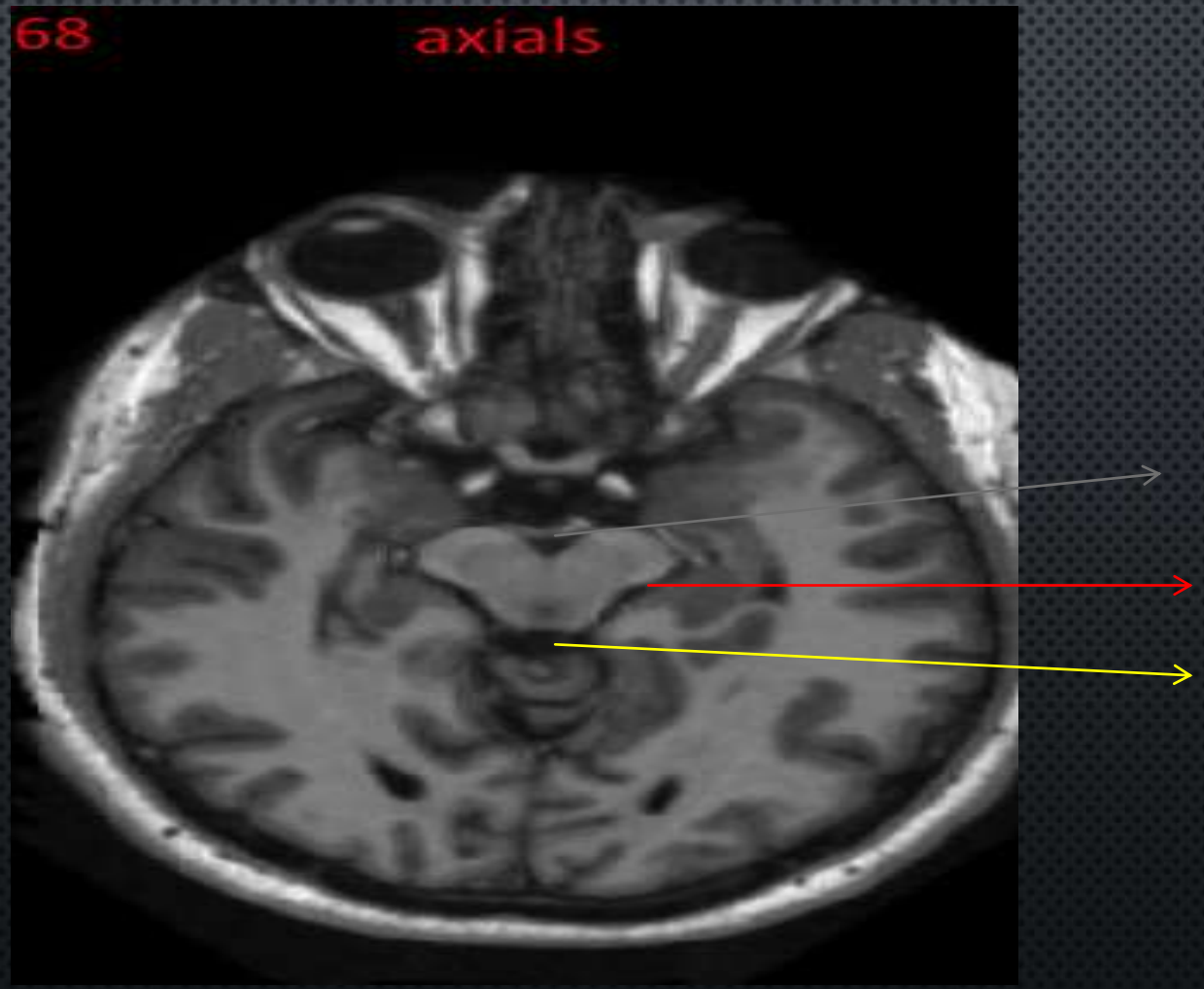


OCCIPITAL LOBE

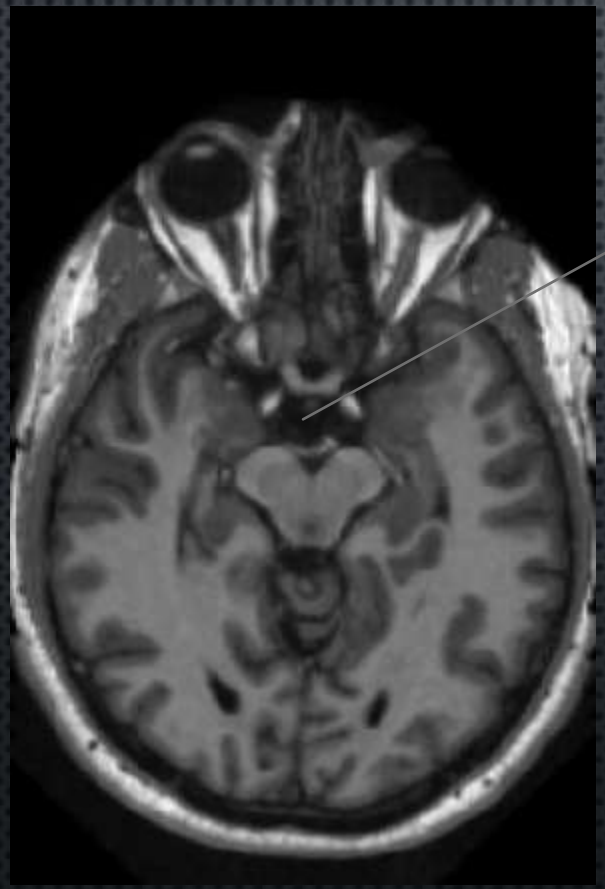


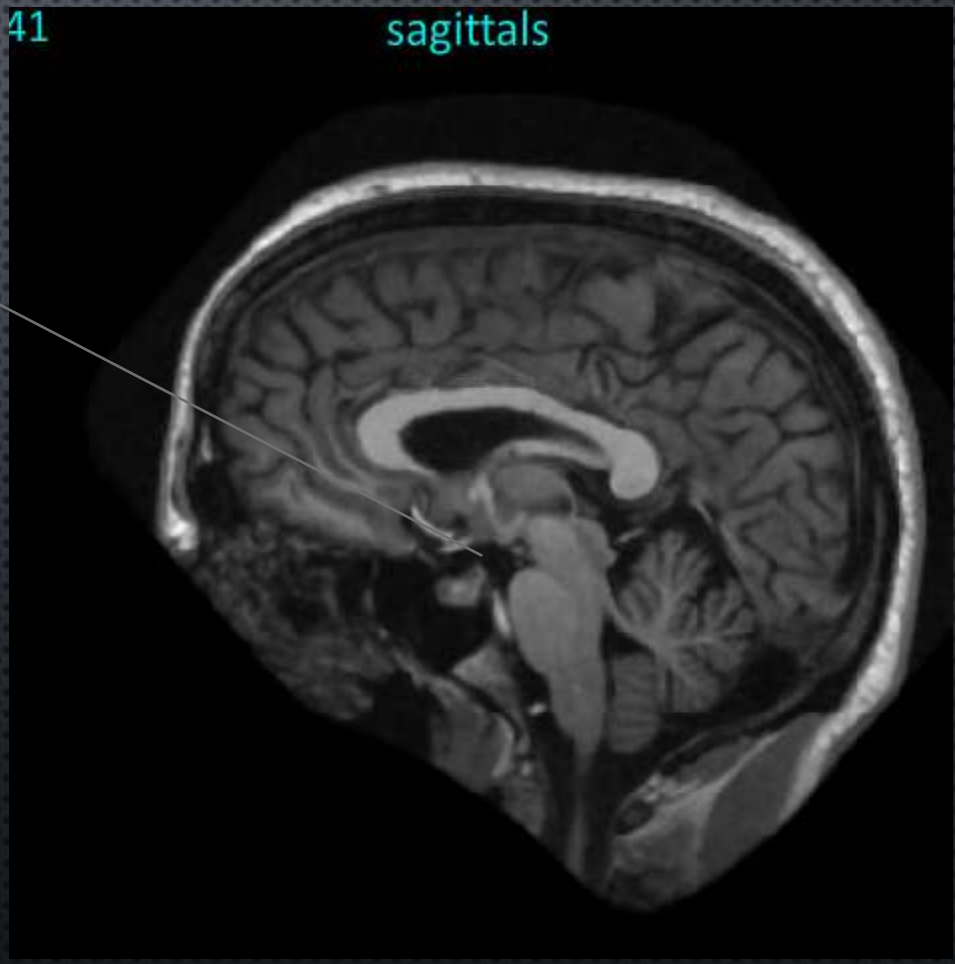
CISTERNS

1-INTRPEDICULAR CISTERN
2-AMBIENT CISTERN
3-QUADRIGEMINAL CISTERN

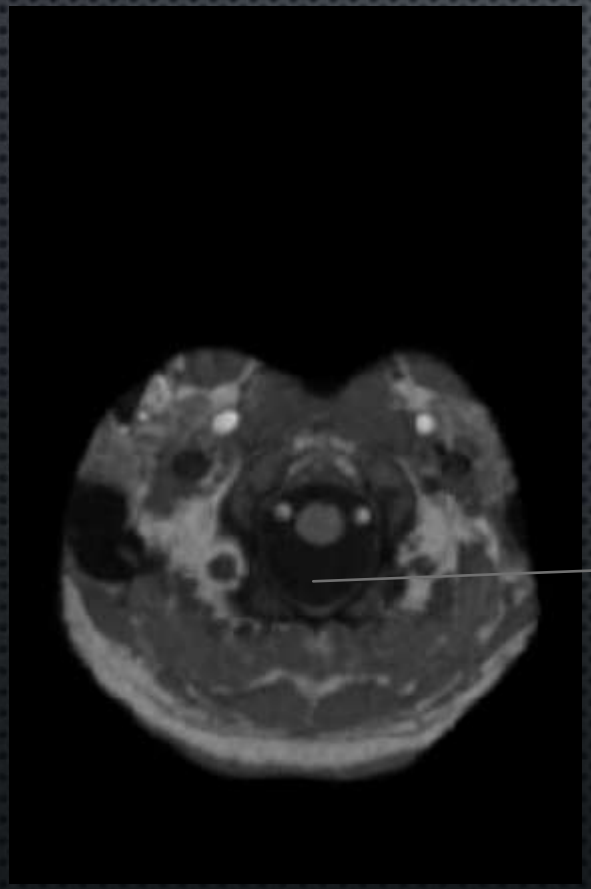


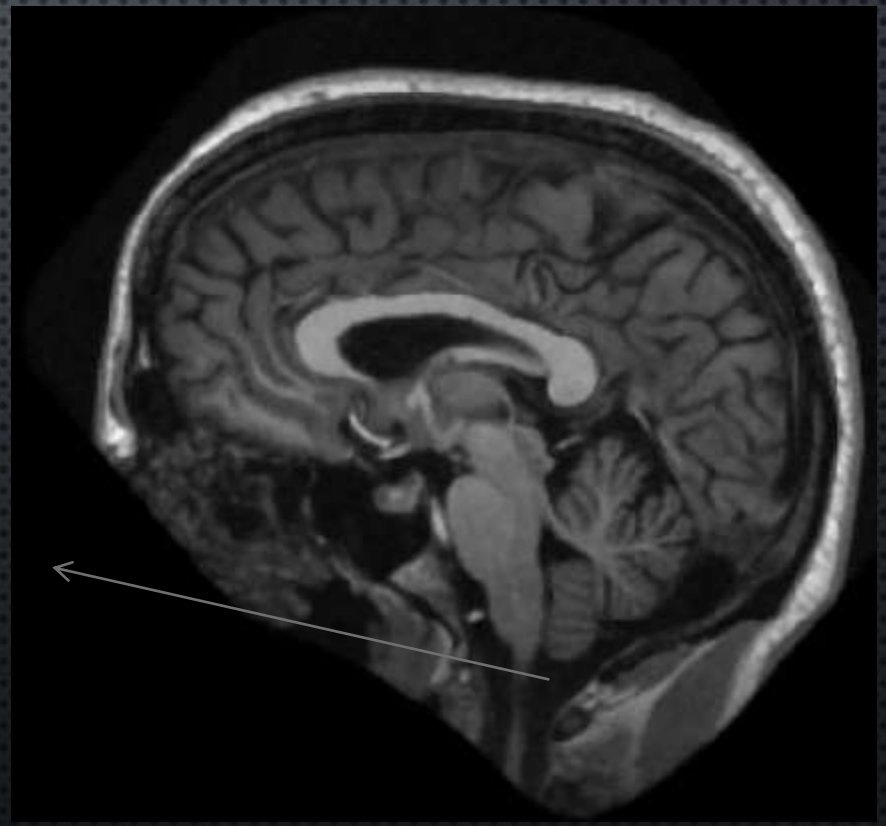
SUPRASELLAR CISTER



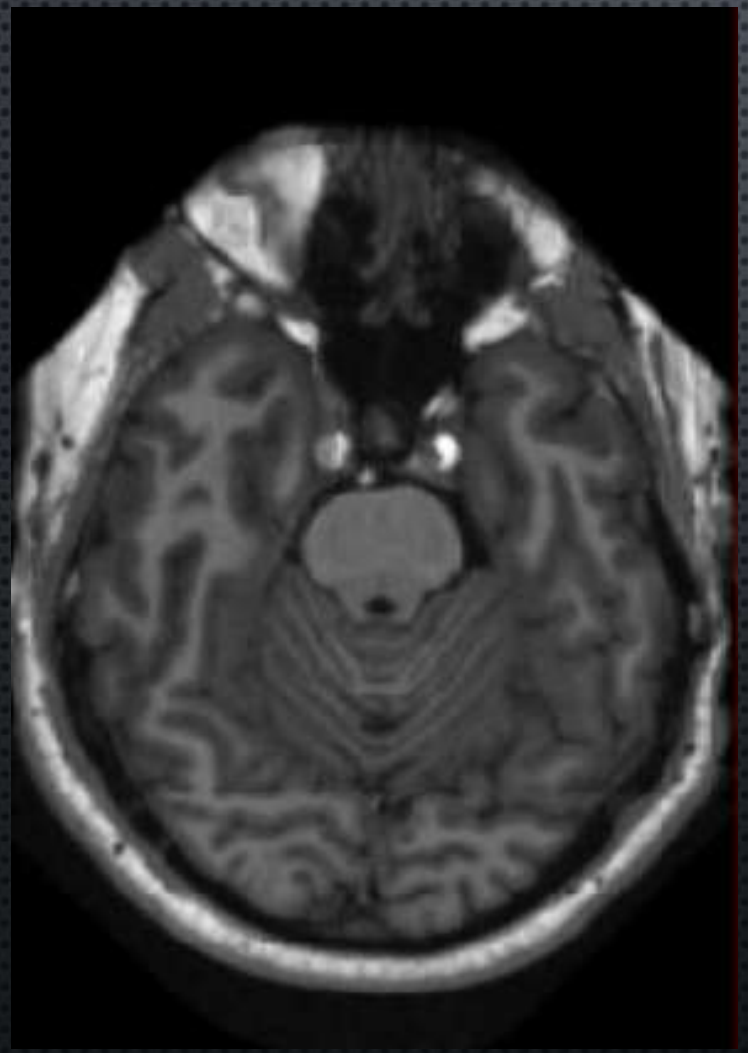


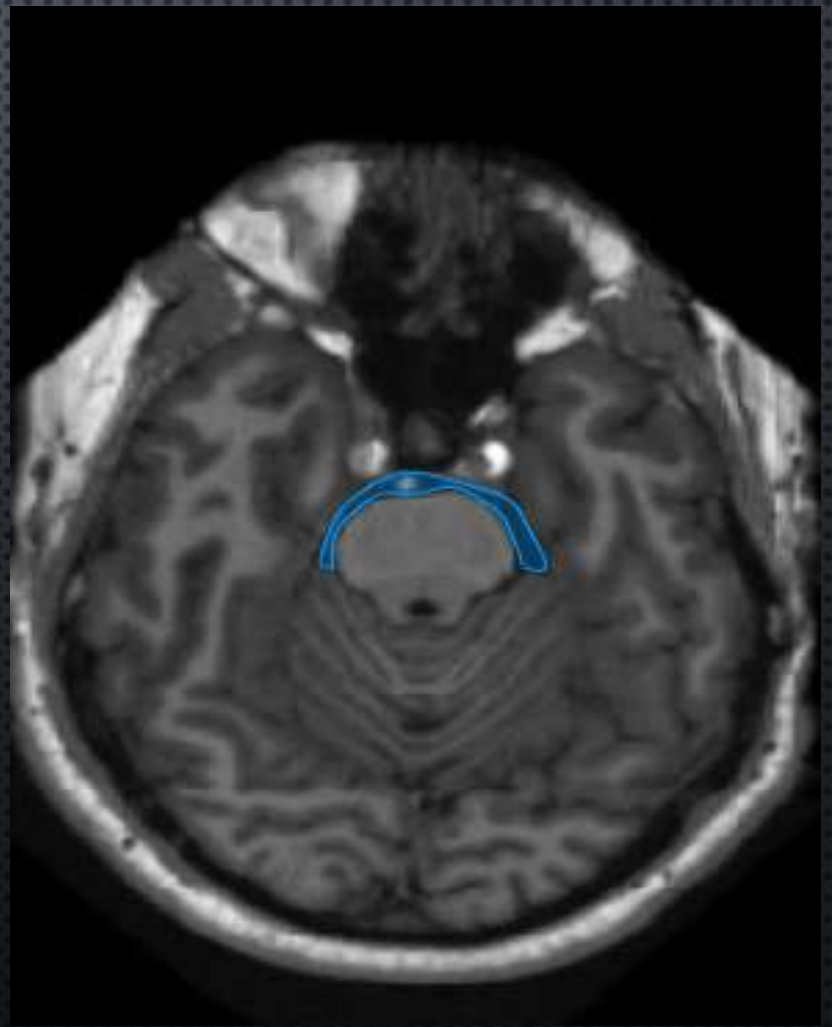
CISTERNA MAGNA





PRE PONTINE CISTERN

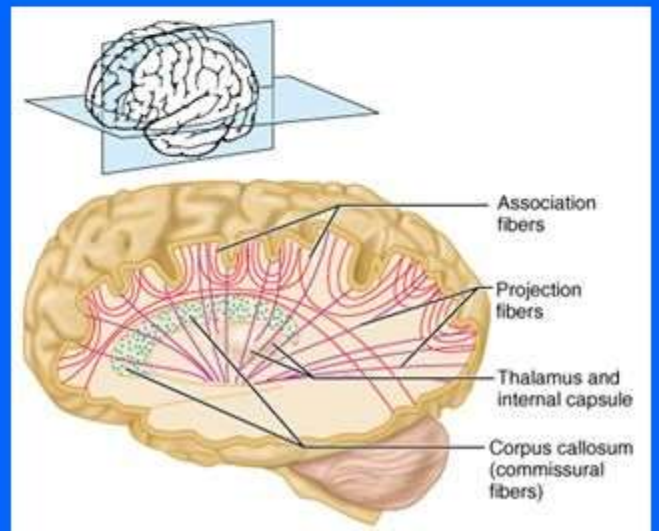


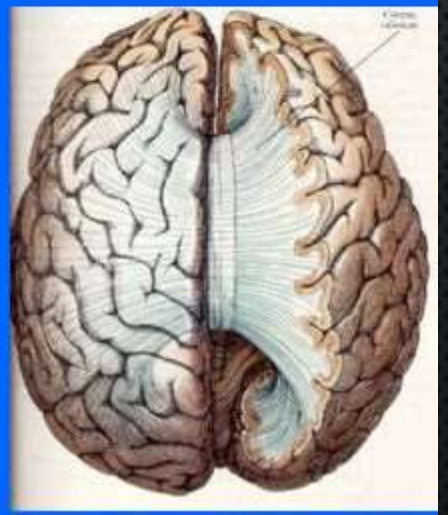


WHITE MATTER

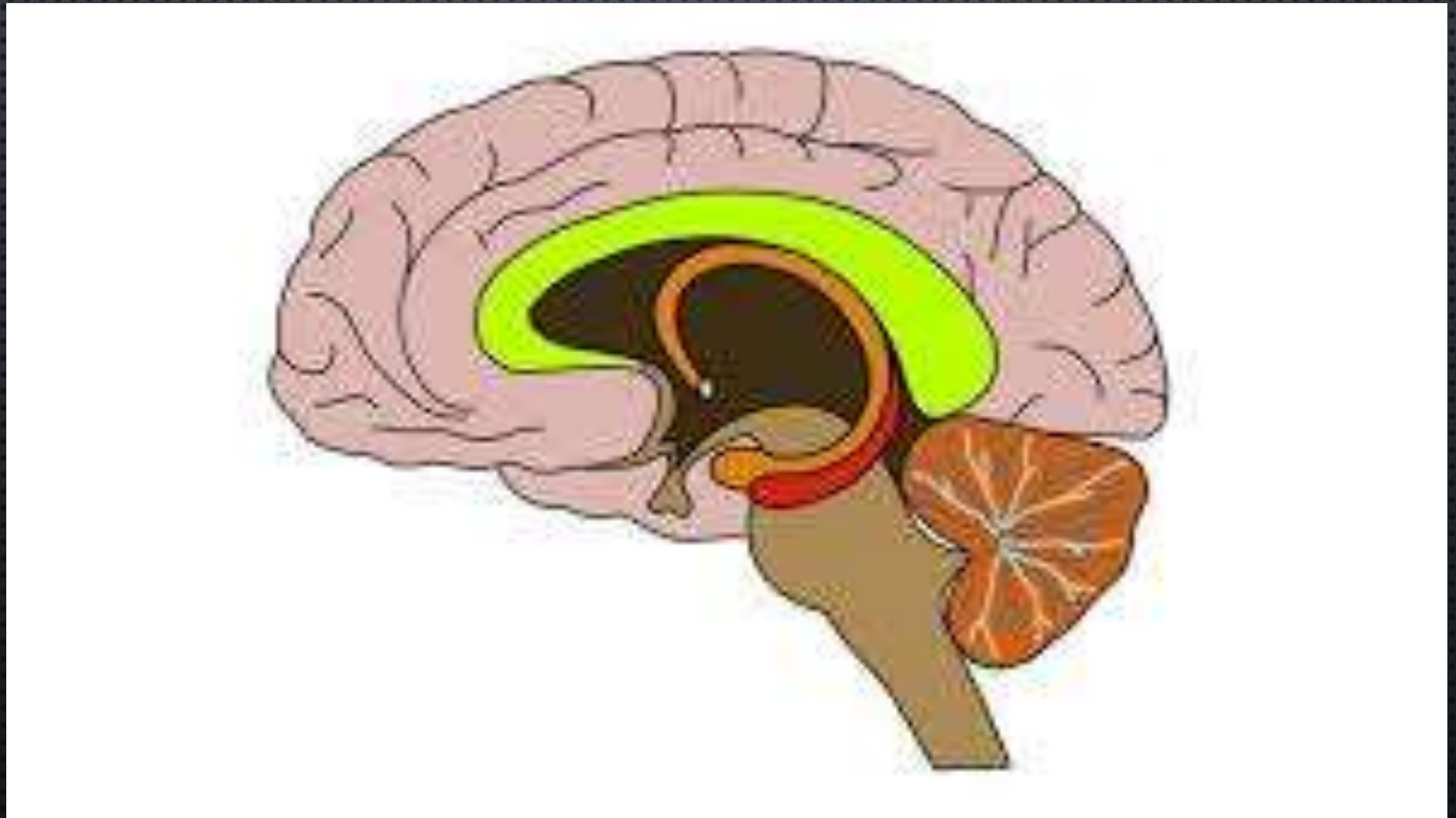
Cerebral White Matter

- Fiber tracts are classified according to the direction in which they run
  - Commisures connect corresponding gray areas of two hemispheres enabling them to function as a whole
    - The largest is the corpus collosum
  - Association fibers connect different parts of the same hemisphere
  - Projection fibers connects the cerebrum and lower brain areas
    - Sensory information reaches the cerebral cortex and motor output leaves it through these fibers

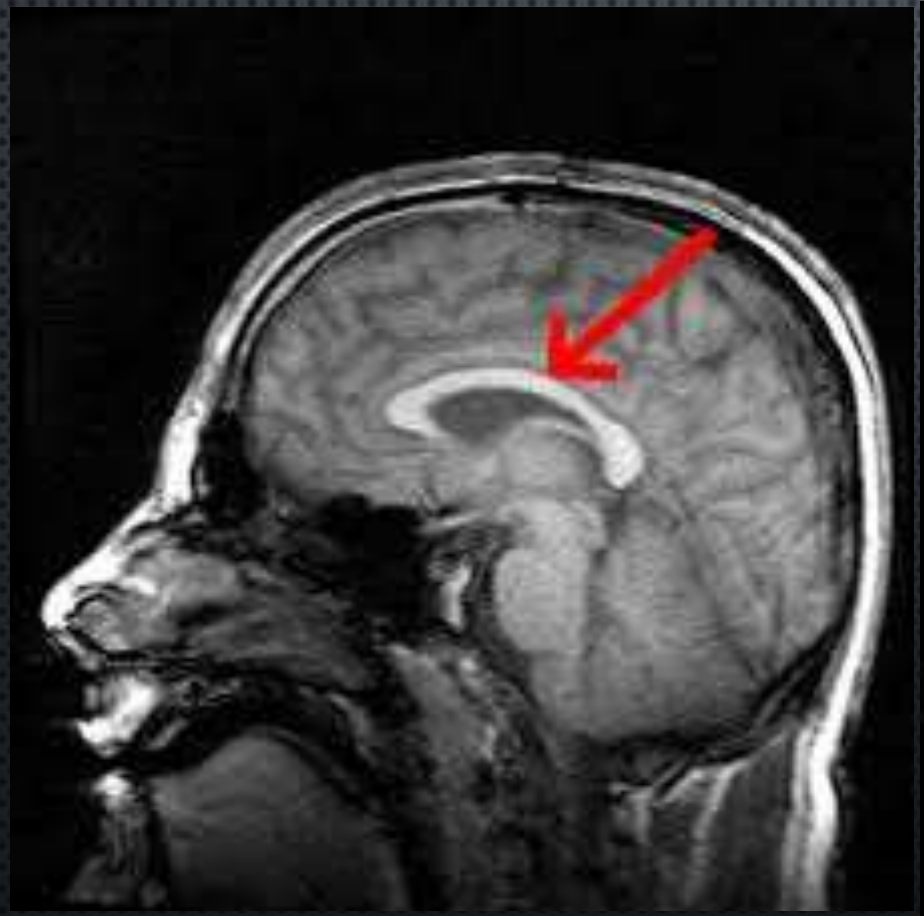




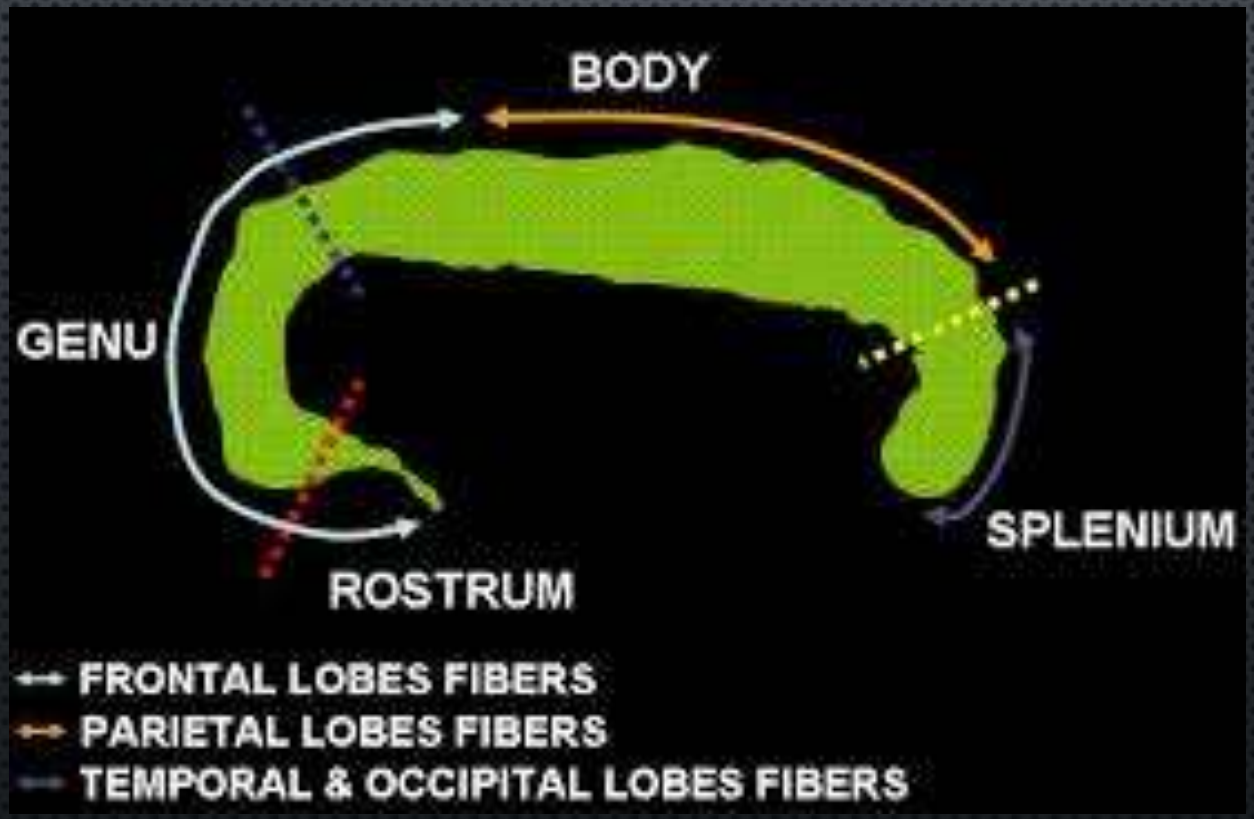
CORPUS CALLOSUM



CORPUS CALLOSUM



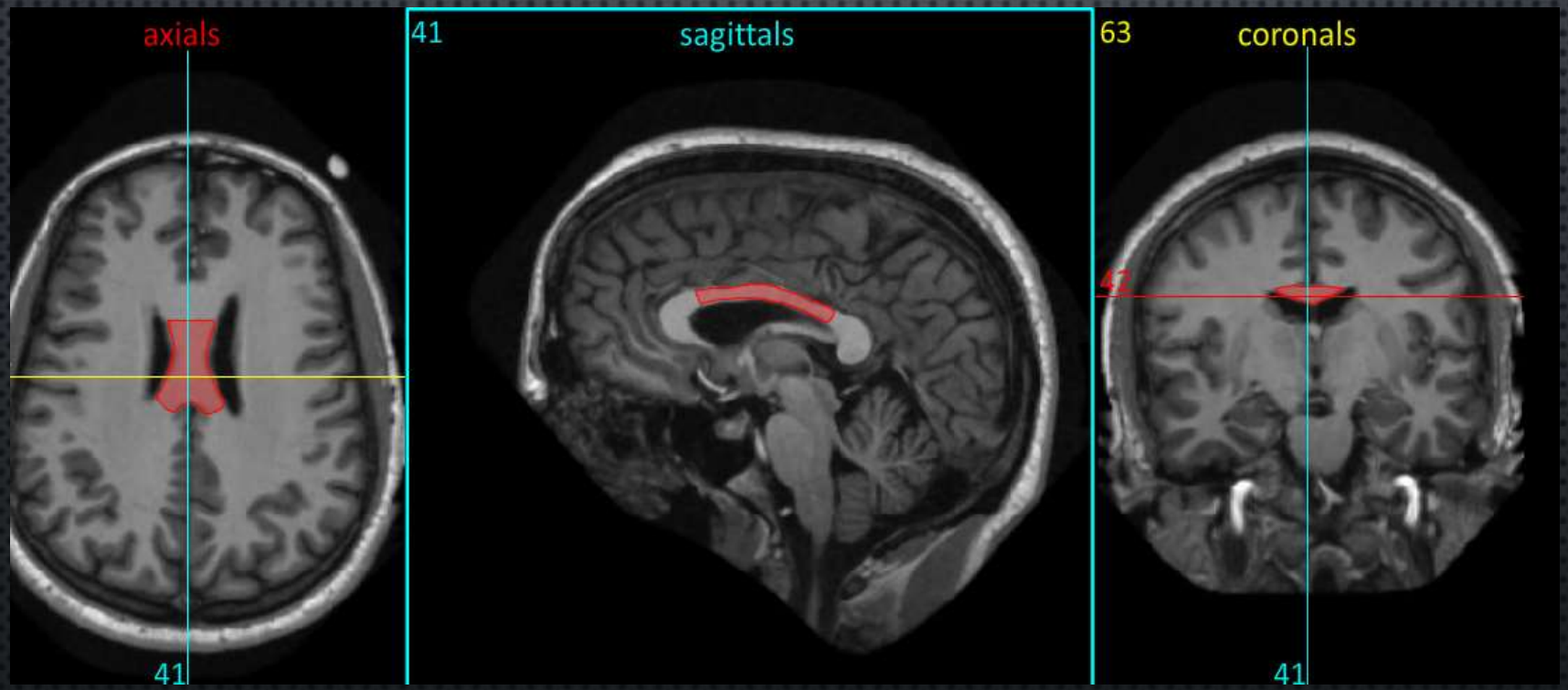
PARTS OF CORPUS CALLOSUM



CORPUS CALLOSUM:ROSTRUM

CORPUS CALLOSUM :GNUE

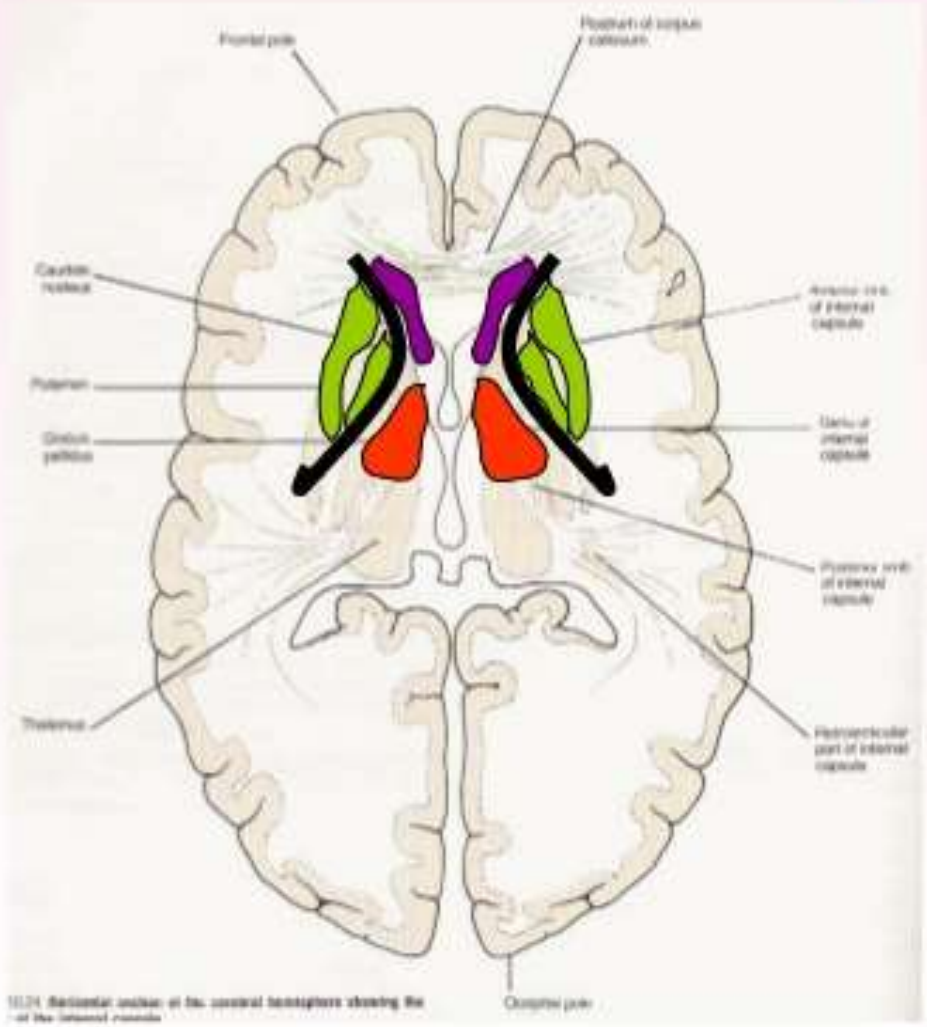
CORPUS CALLOSUM :BODY



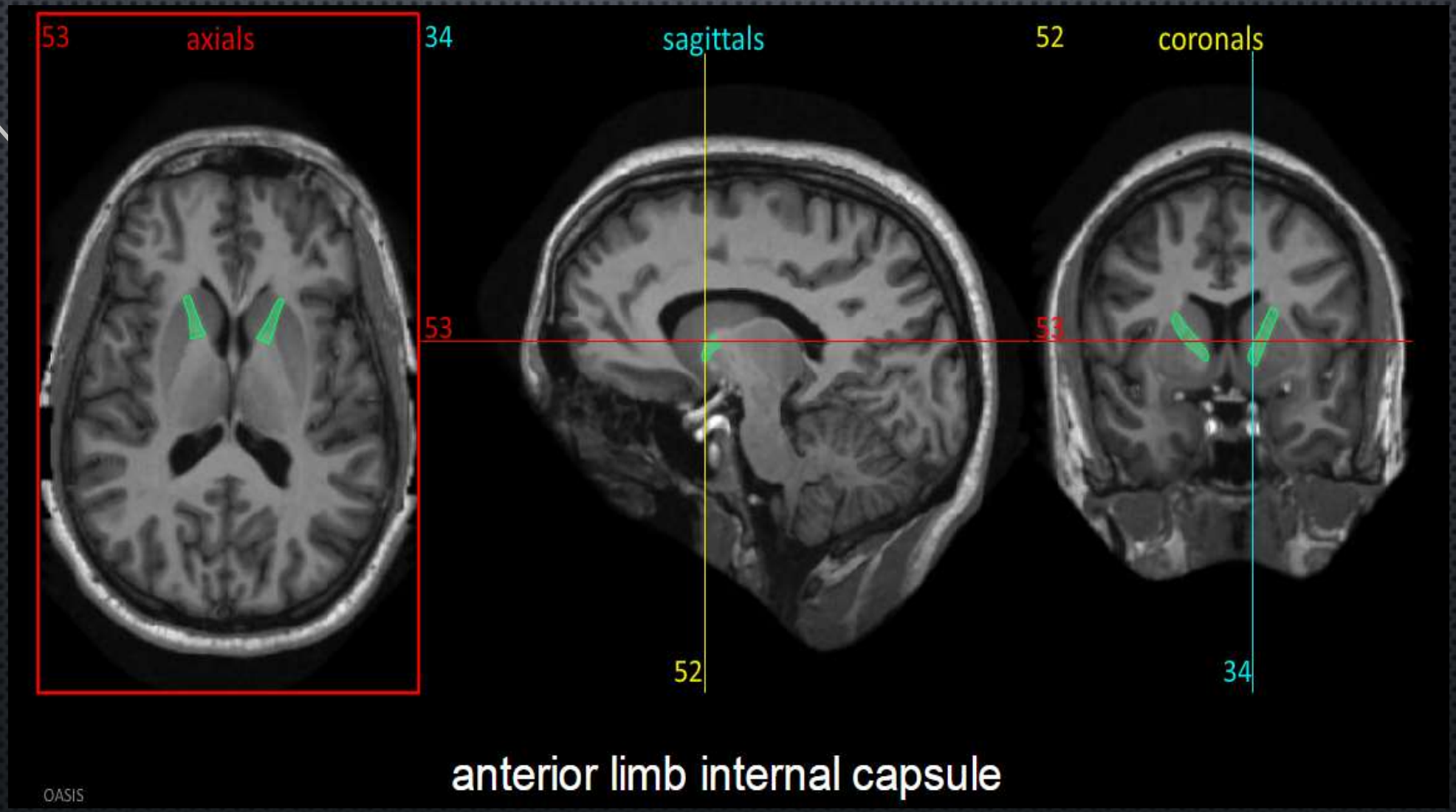
CORPUS CALLOSUM SPLENUIM

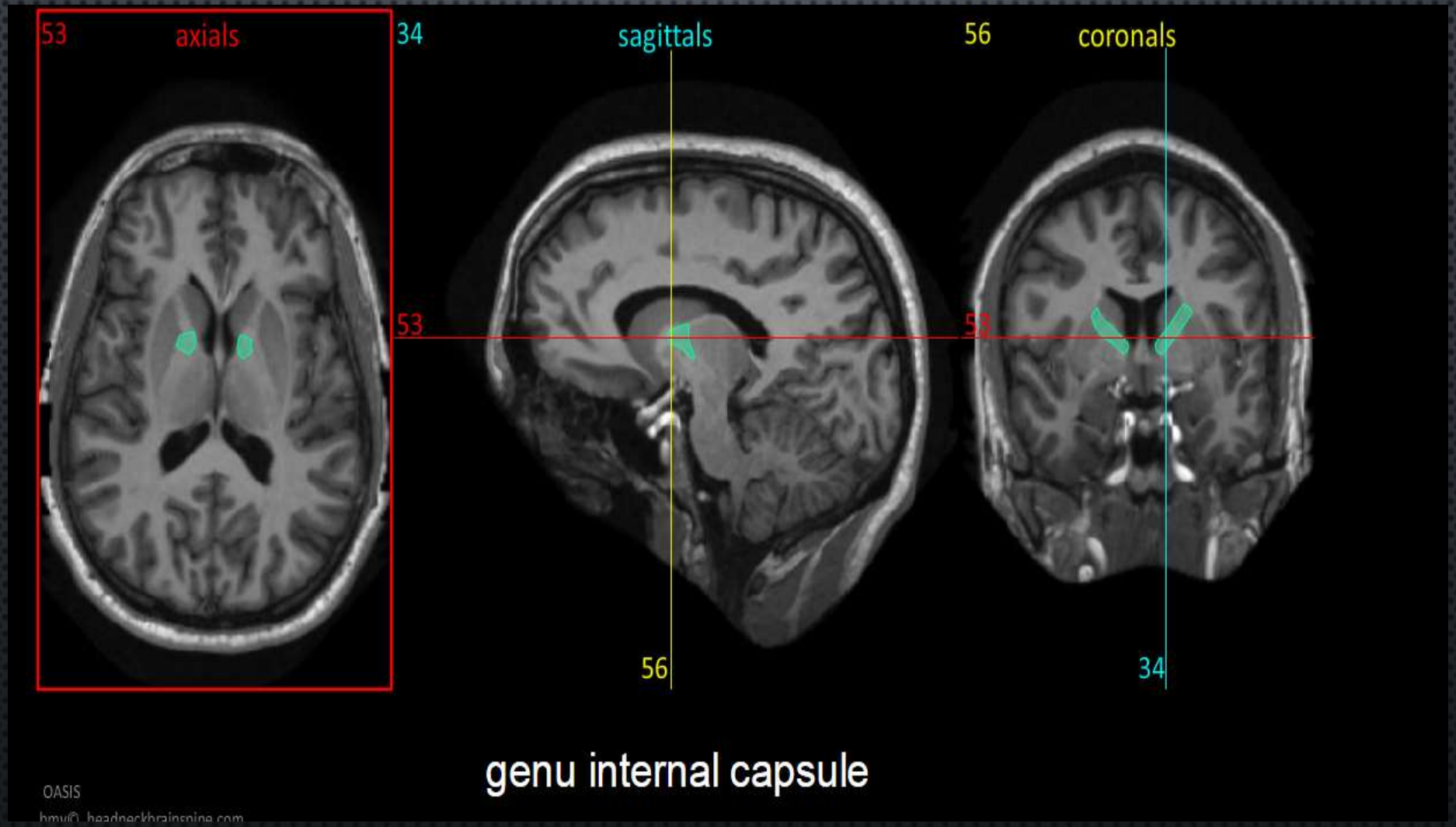
Internal Capsule

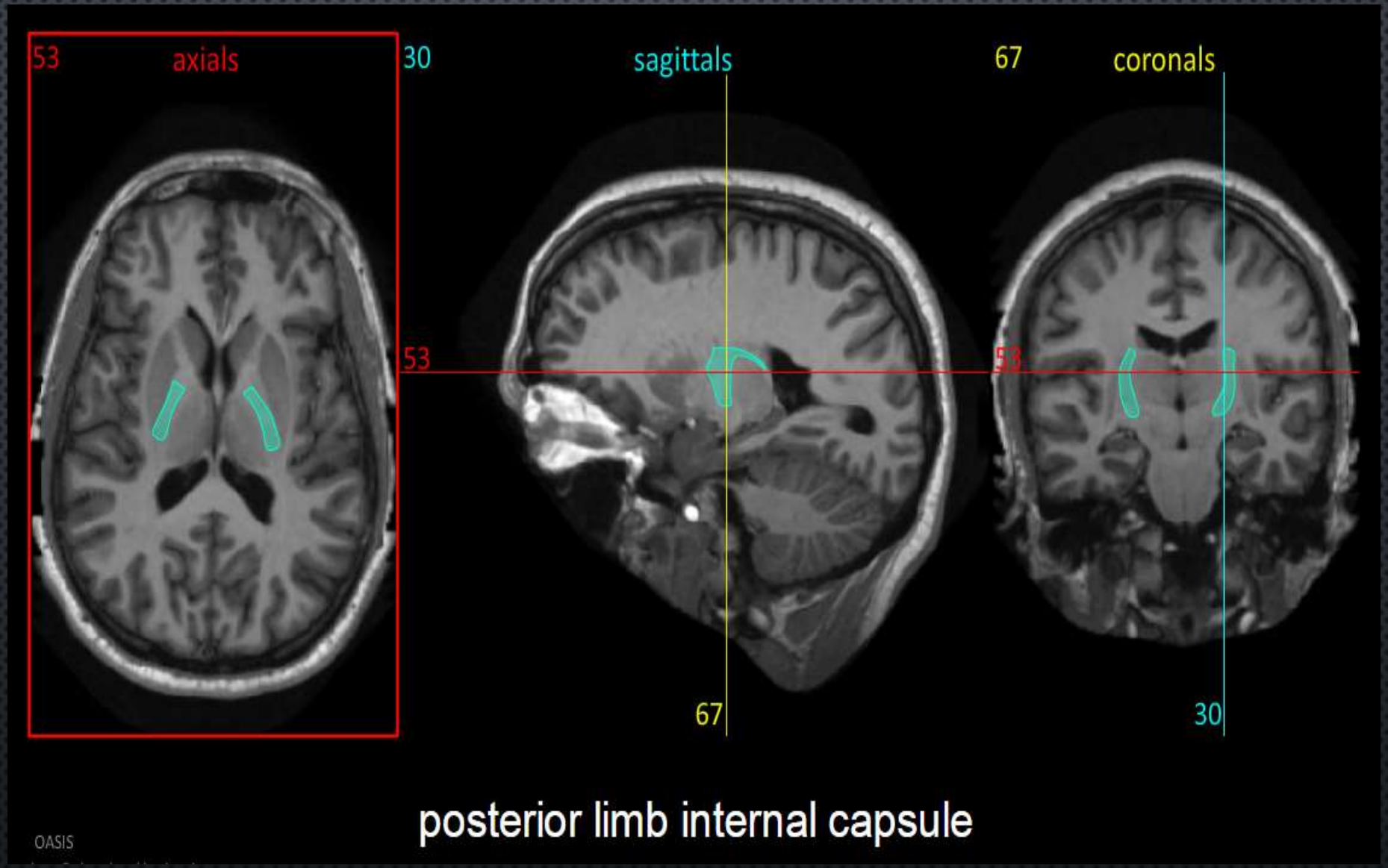
- Projection fibres (white matter) between caudate nucleus and thalamus medially and lentiform nucleus laterally



IN

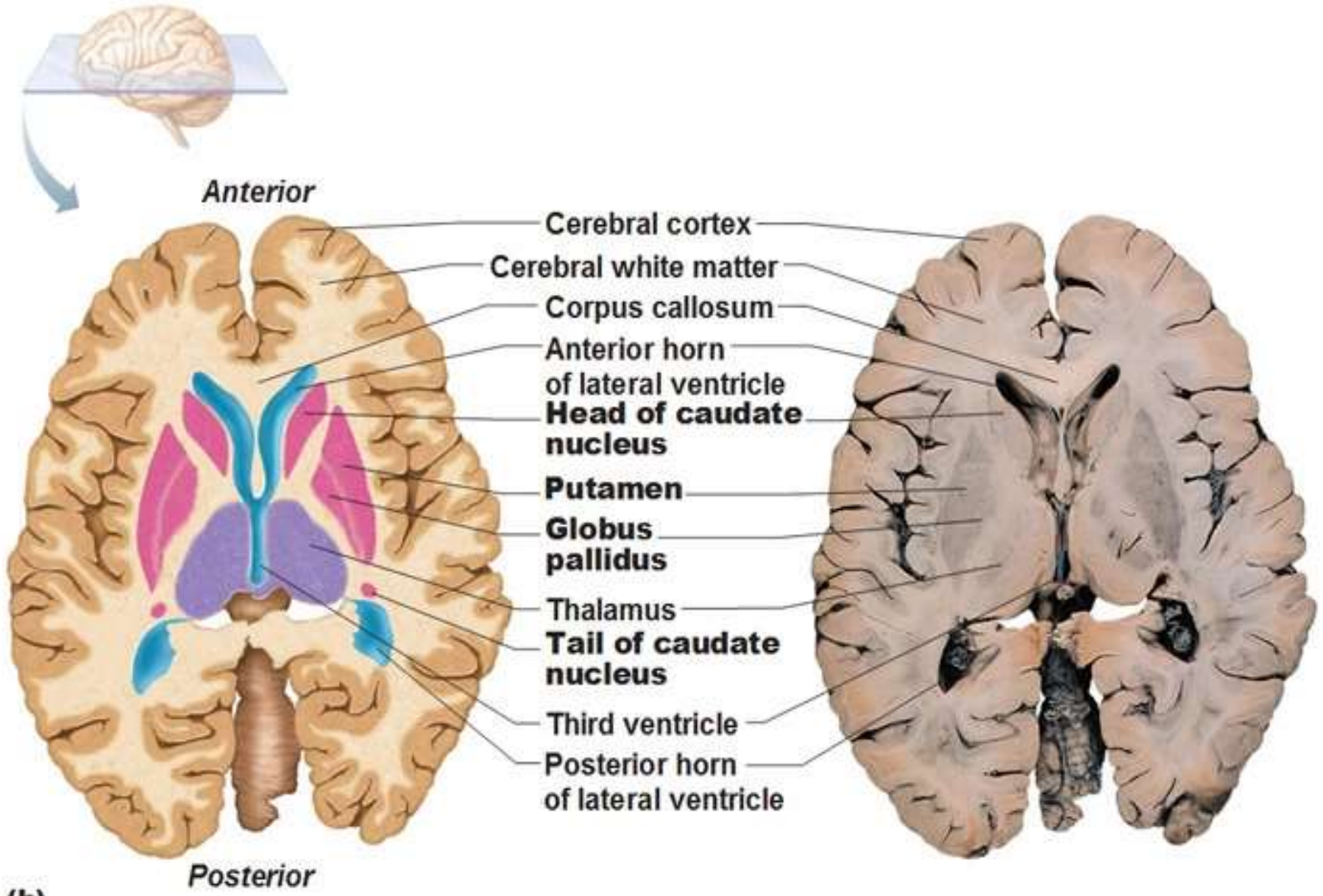

53
axials
34
sagittals
52
coronals
53
53
52
34
OASIS
anterior limb internal capsule

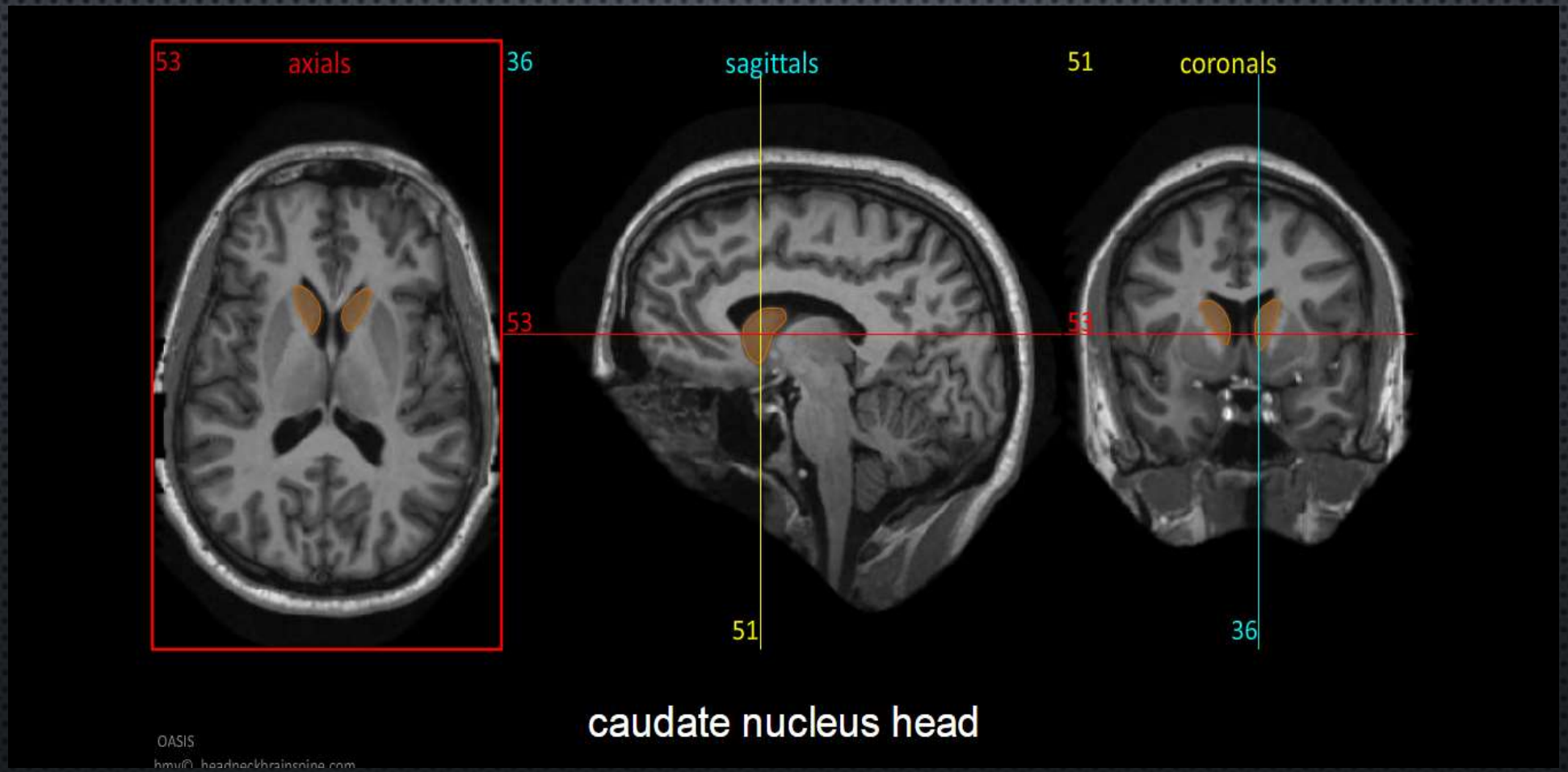

53
axials
34
sagittals
56
coronals
53
53
56
34
genu internal capsule
OASIS

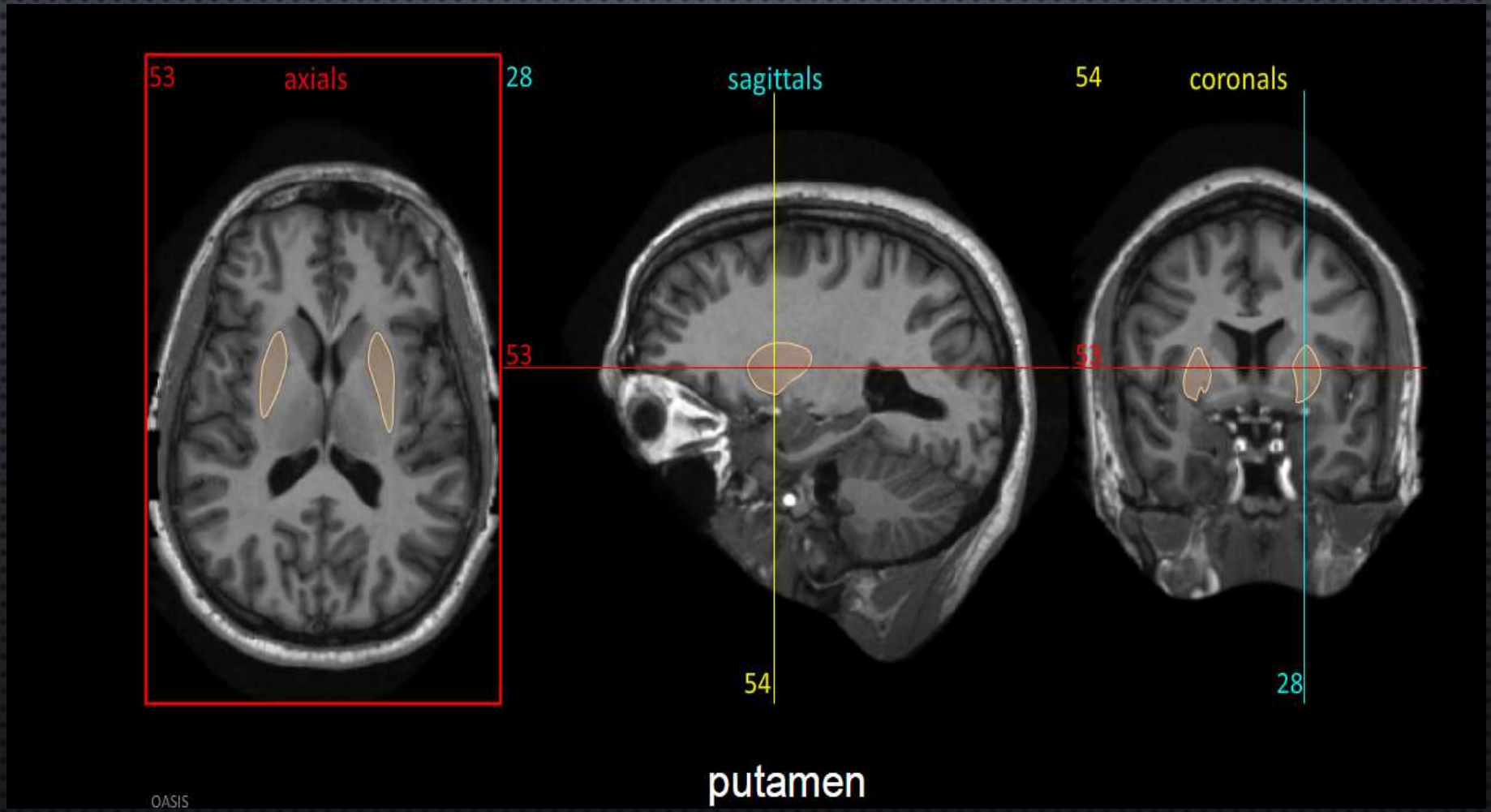

53
axials
30
sagittals
67
coronals
53
53
67
30
posterior limb internal capsule
OASIS

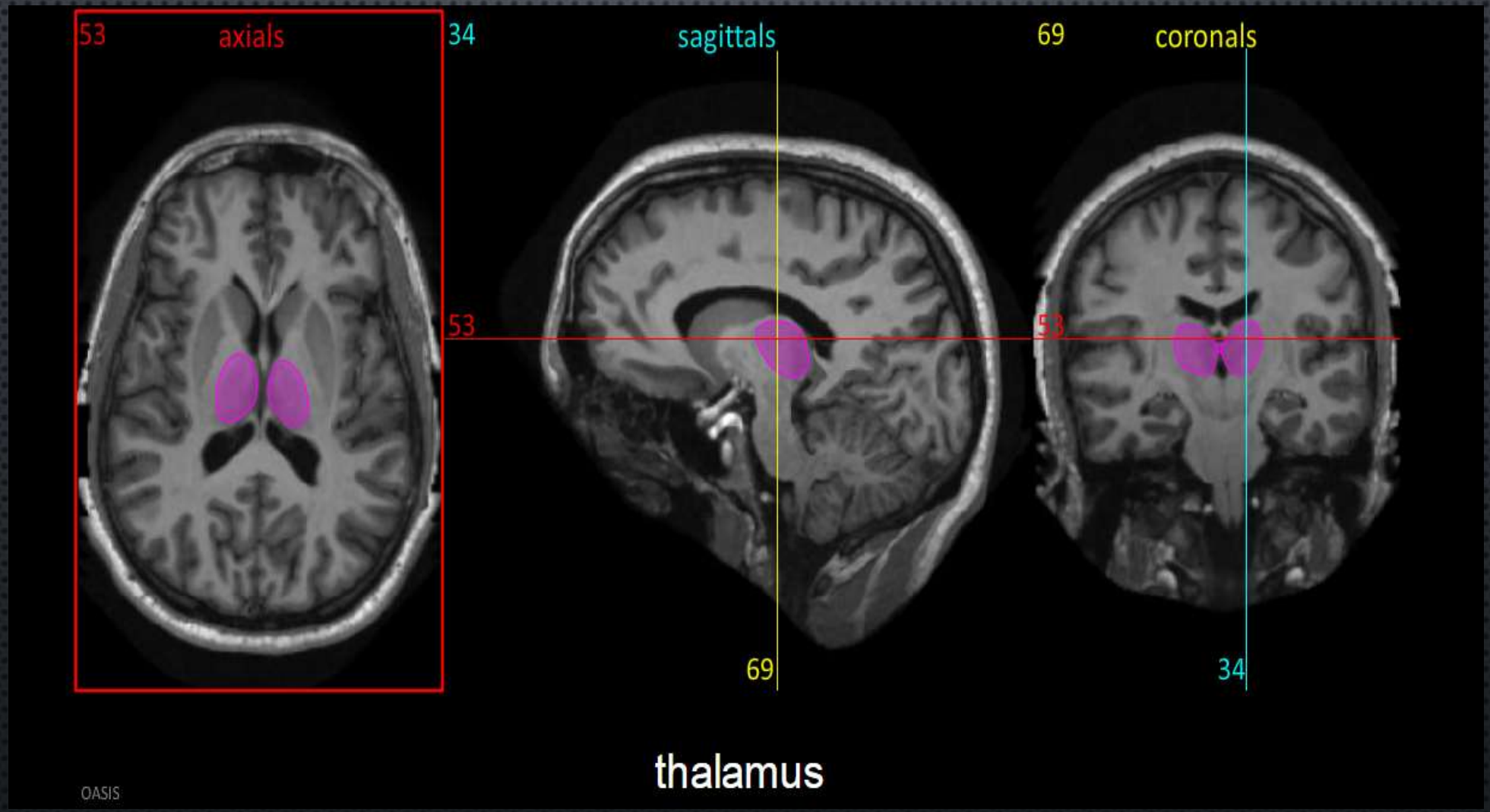
GREY MATTER

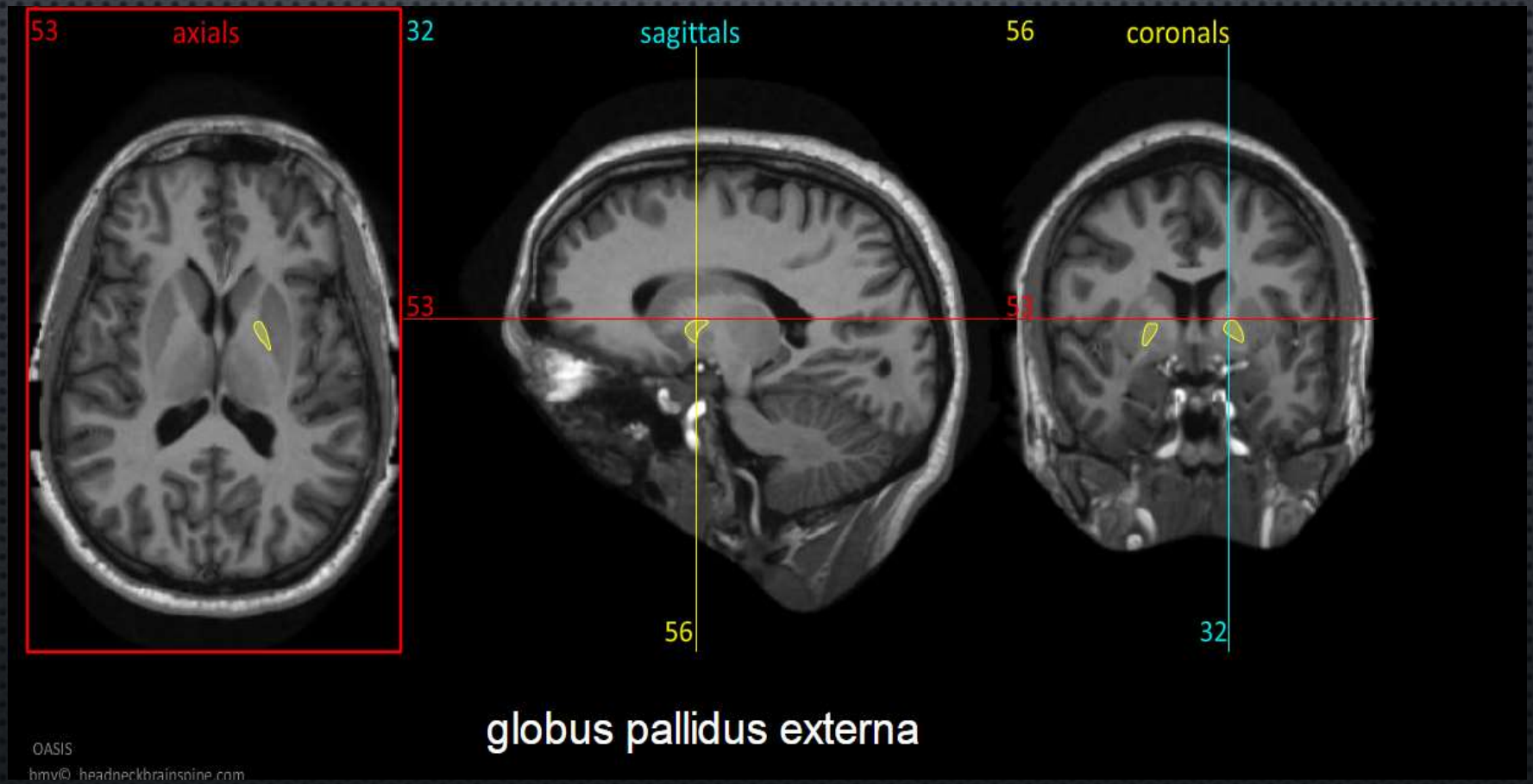
Basal Ganglia – relationships to ventricles and thalamus




53
axials
36
sagittals
51
coronals
53
53
51
36
caudate nucleus head
OASIS


53
axials
28
sagittals
54
coronals
53
53
54
28
OASIS
putamen

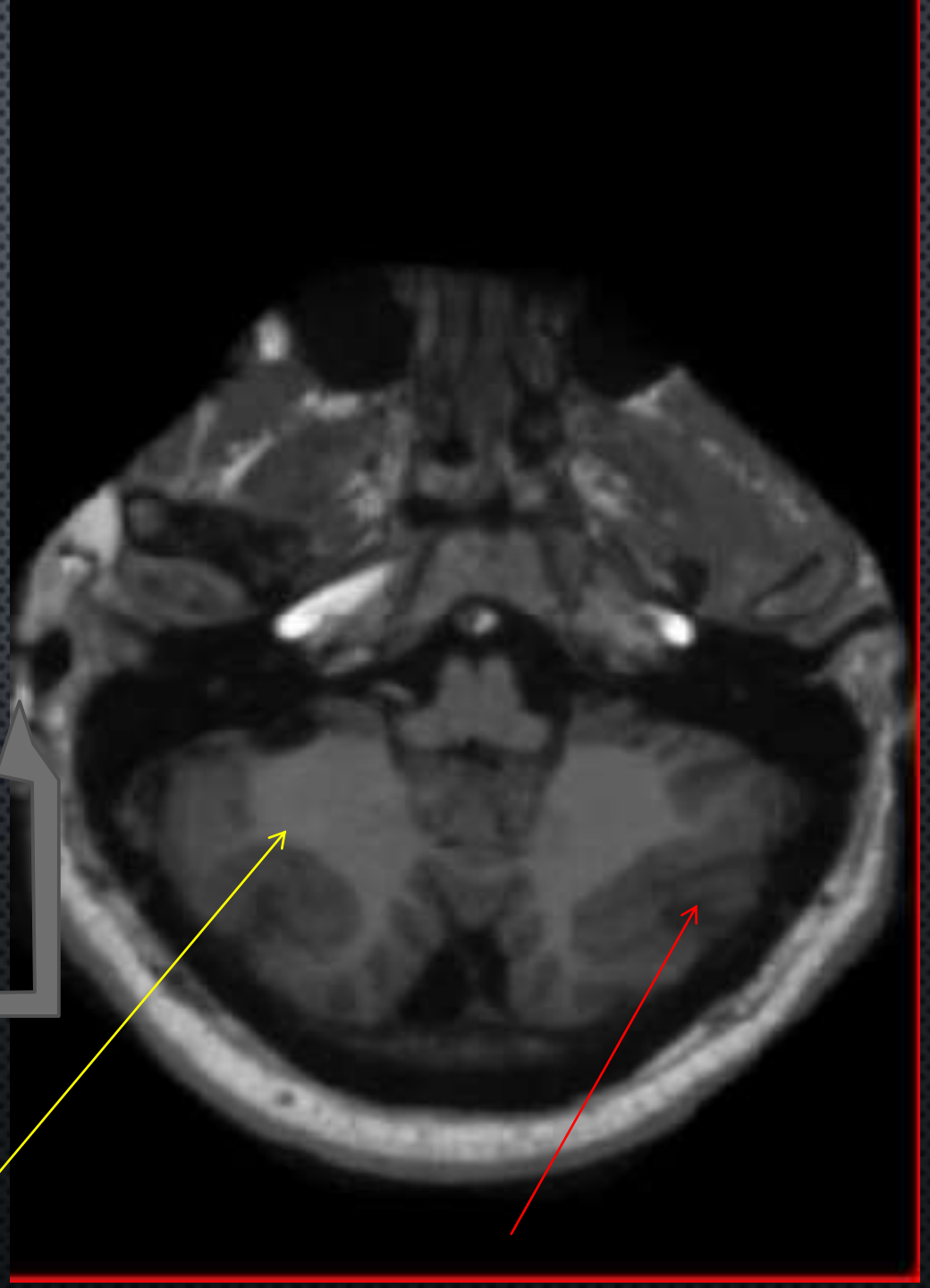

53
axials
34
sagittals
69
coronals
53
53
69
34
thalamus
OASIS


53
axials
32
sagittals
56
coronals
53
53
56
32
globus pallidus externa
OASIS
hmv© headneckbrainspine.com

CREBELLUM

CEREBELLUM

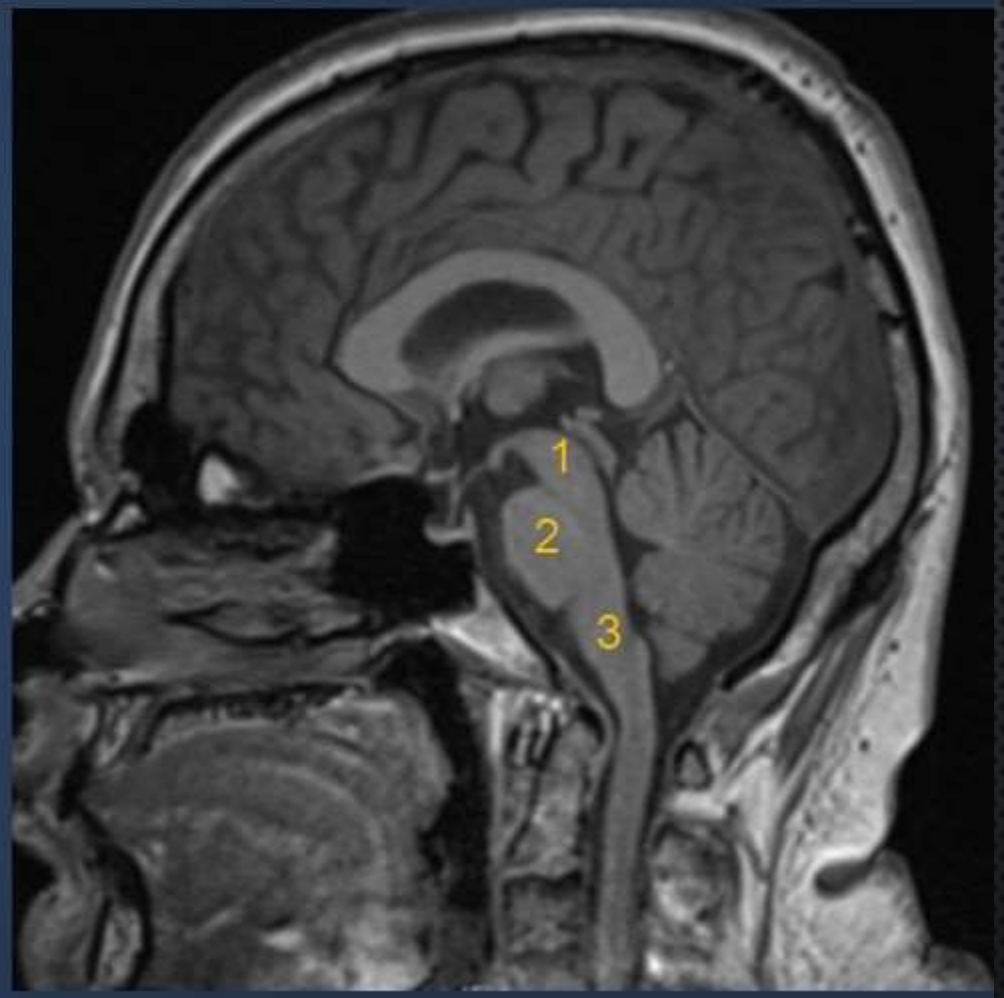
- 1.RT CERBELLAR LOBE
- 2-LT CEREBELLAR LOBE
- 3.VERMIS



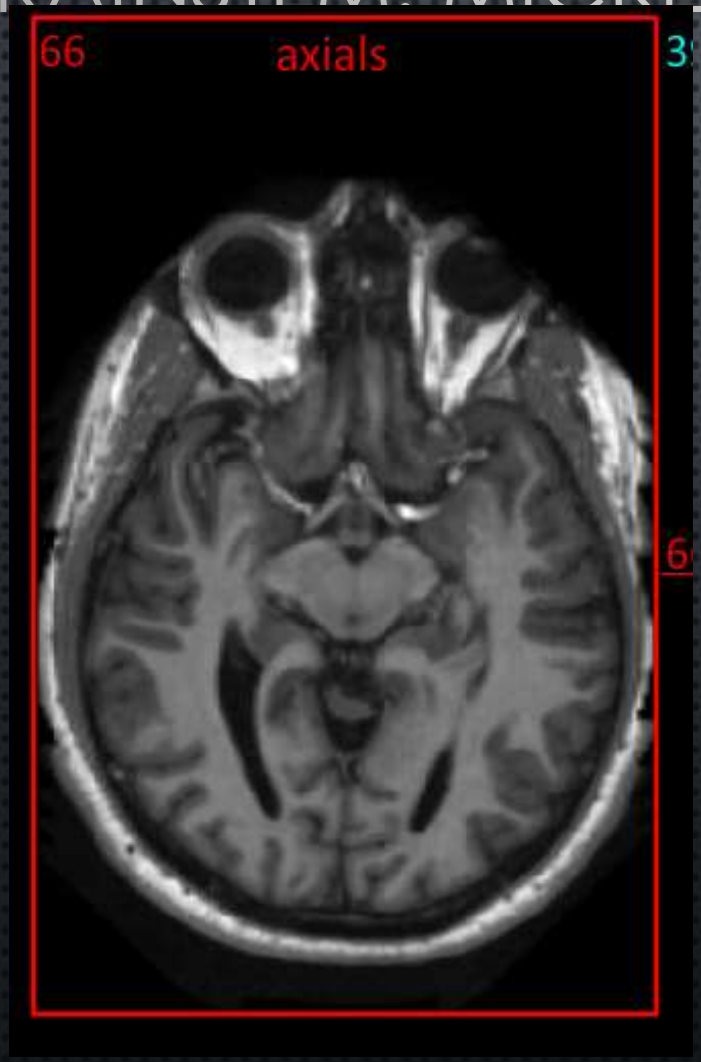
BRAINSTEM

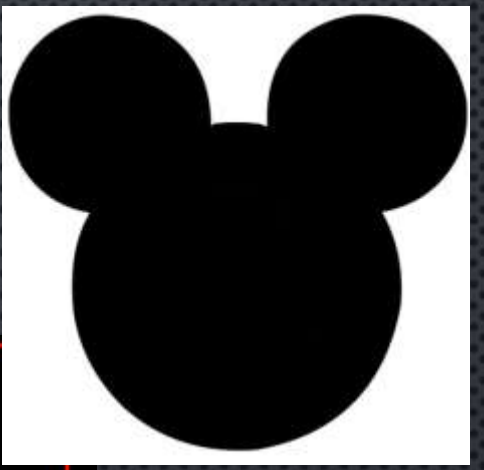
Brain Stem..

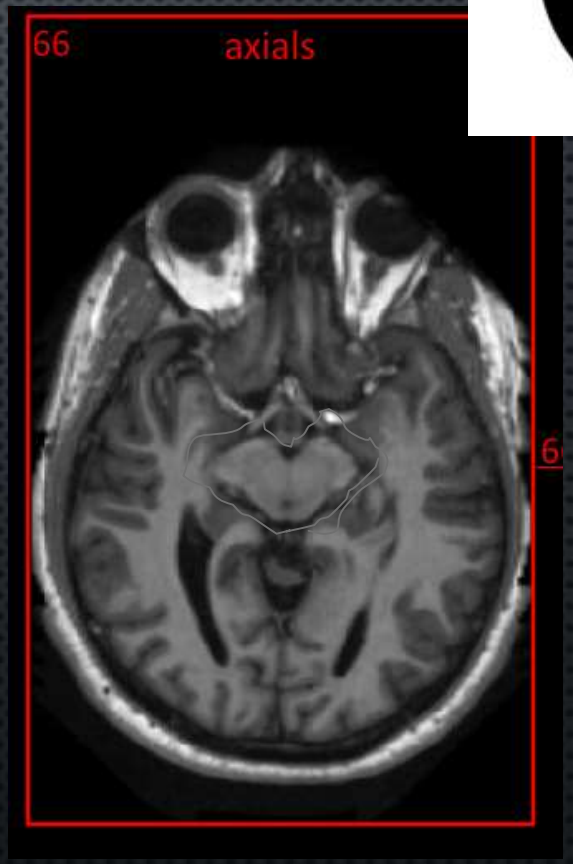
- Three parts from superior to inferior:
  - 1 midbrain
  - 2 pons
  - 3 medulla oblongata
- Connects cerebral hemisphere with spinal cord



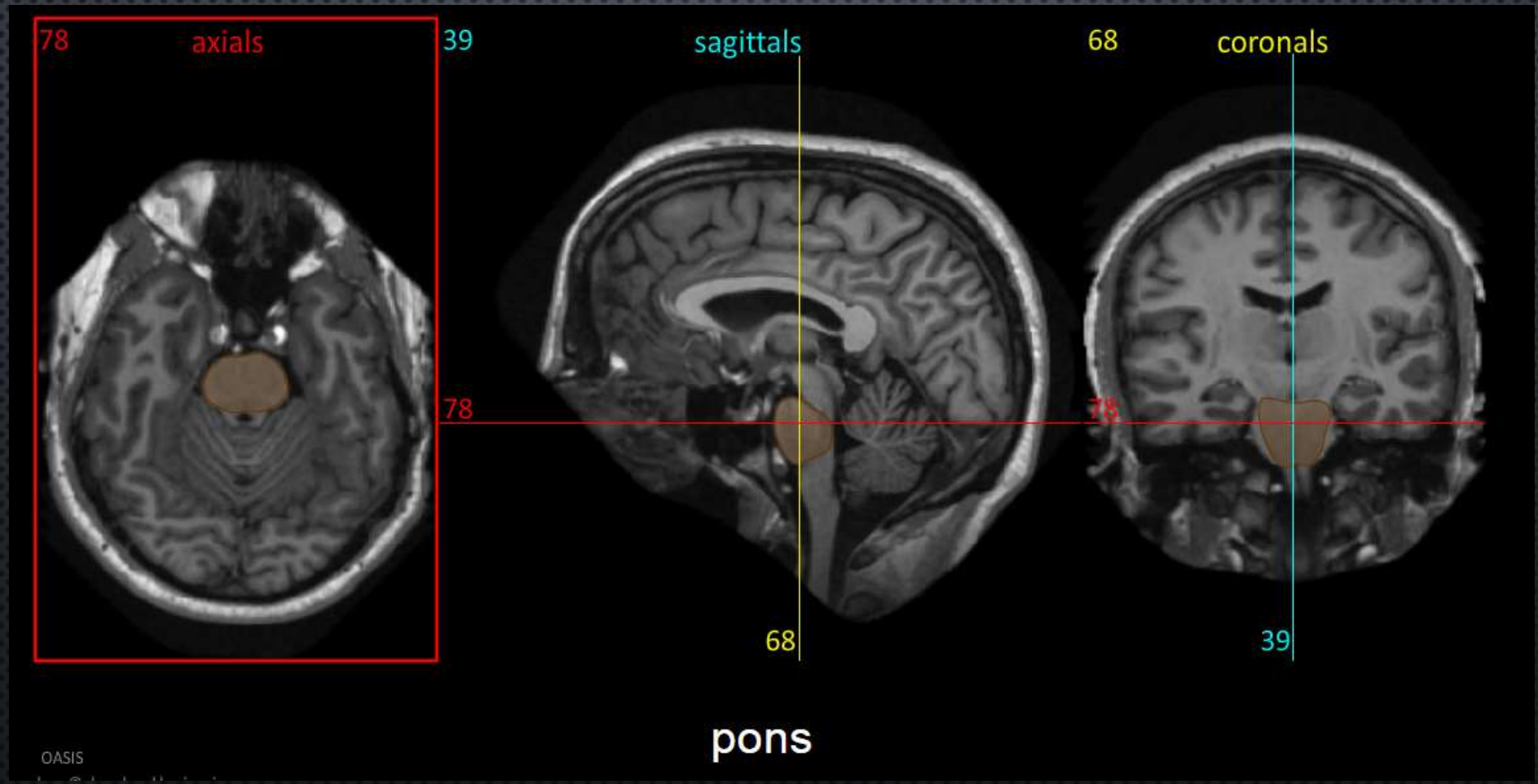
BRAINSTEM: MICKEY MOUSE HEAD



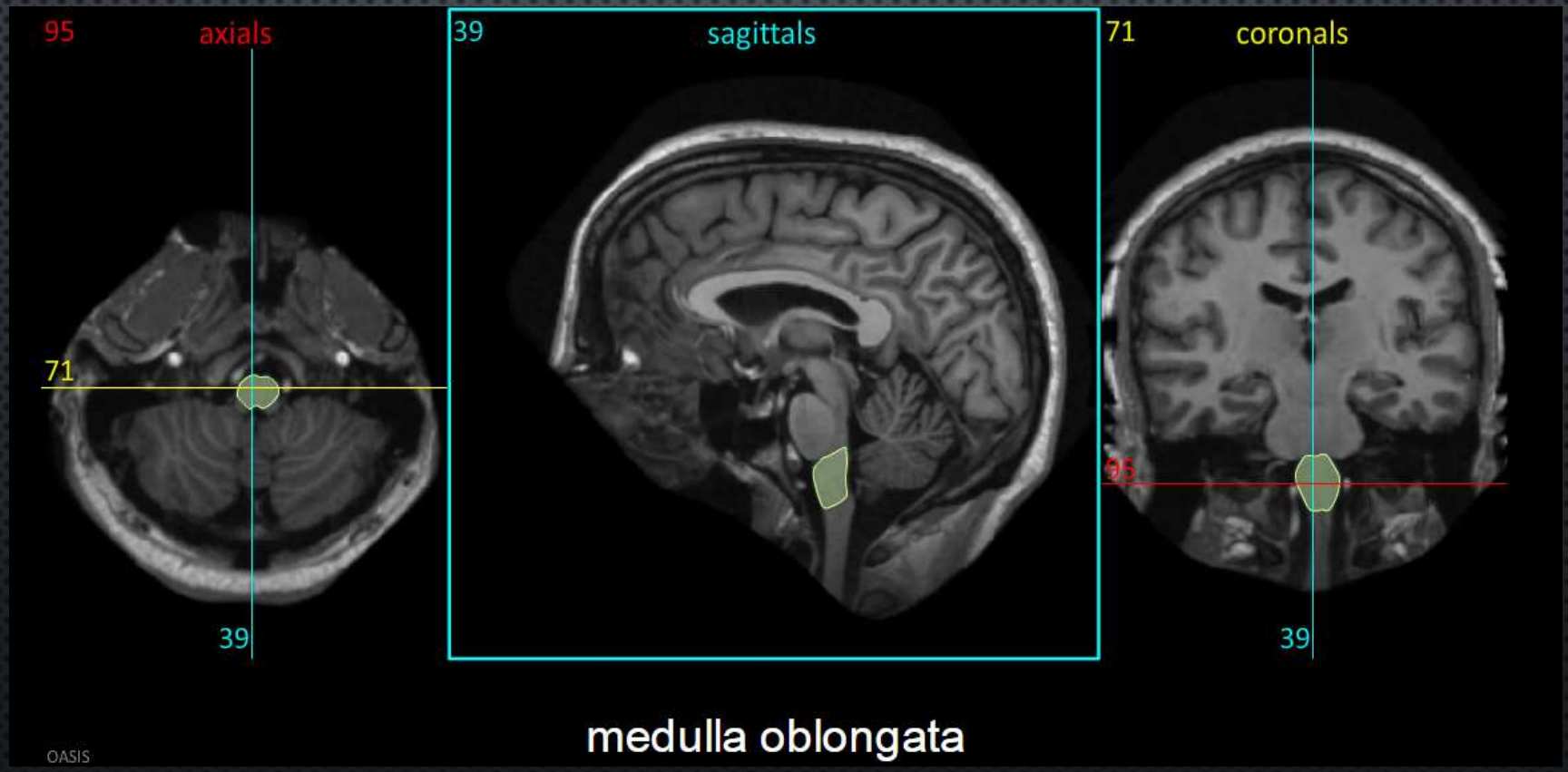




PONS: ANTERIOR CONVEX BORDER



MEDULLA OBLONGATA

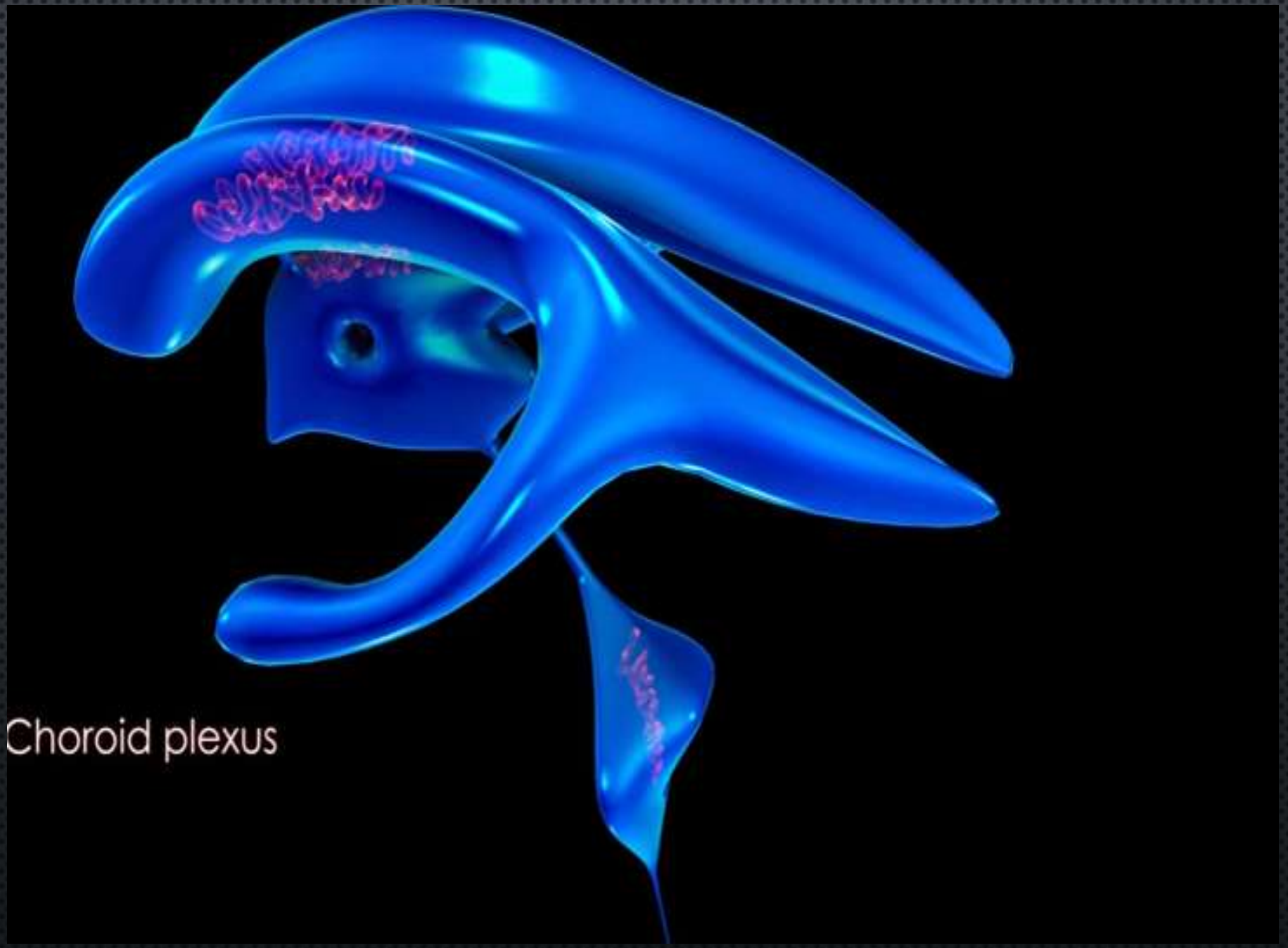


VENTRICULAR SYSTEM

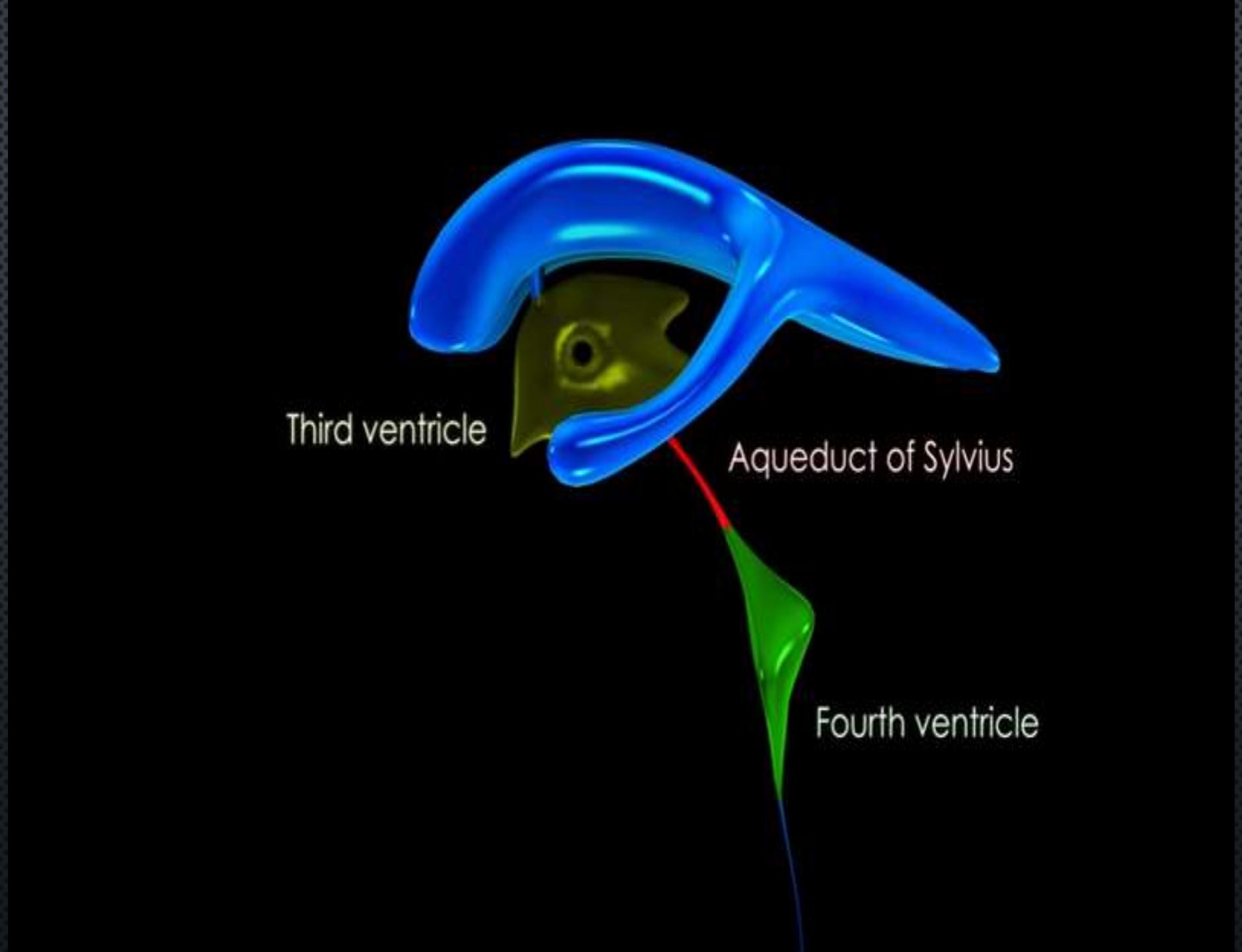
The CerebroSpinal Fluid
CSF

Functions

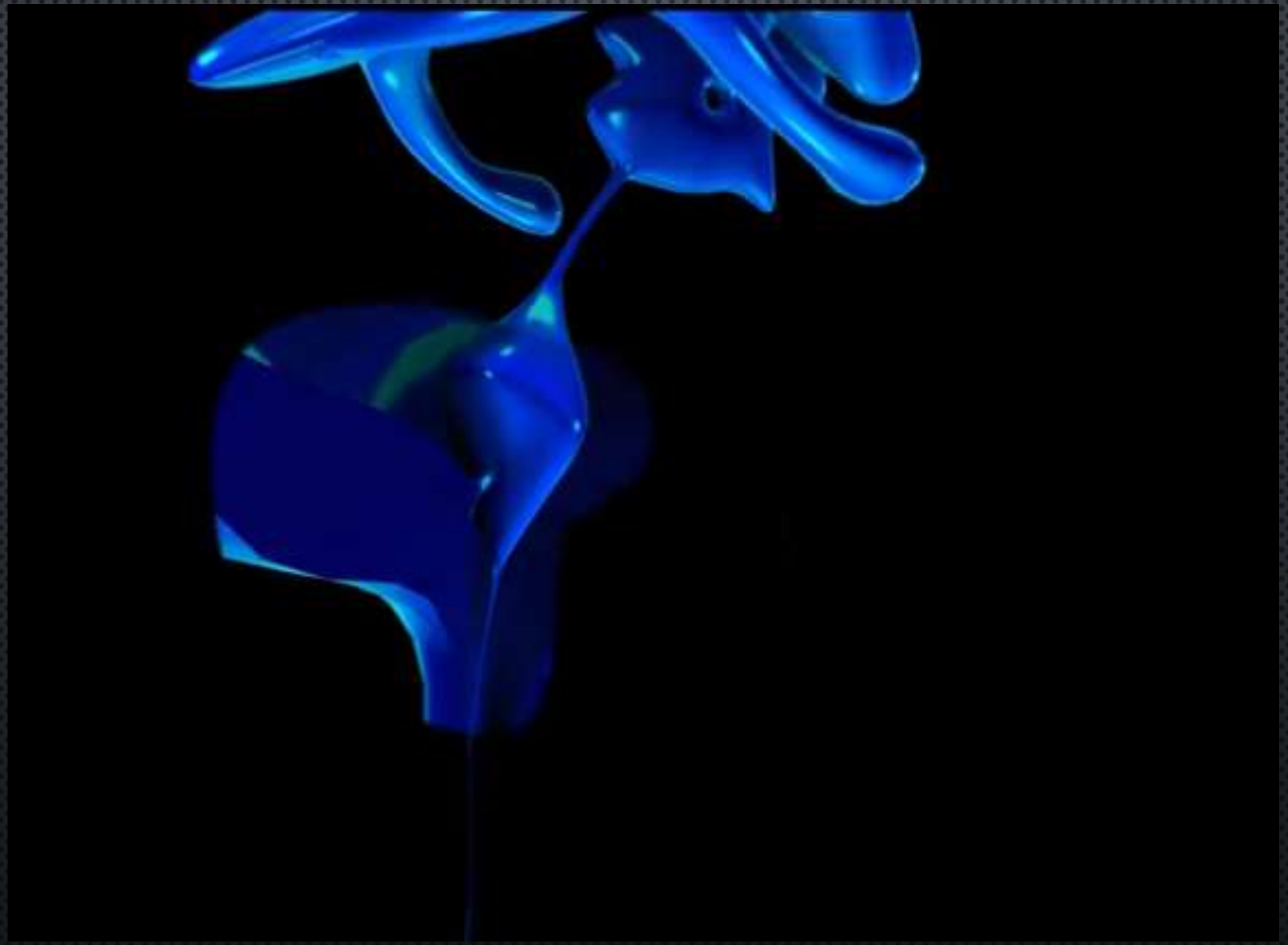
- Mechanical protection
- Intracranial pressure
- Metabolic function
- Other functions


Choroid plexus


Lateral ventricles
Foramina of Monro
Third ventricle

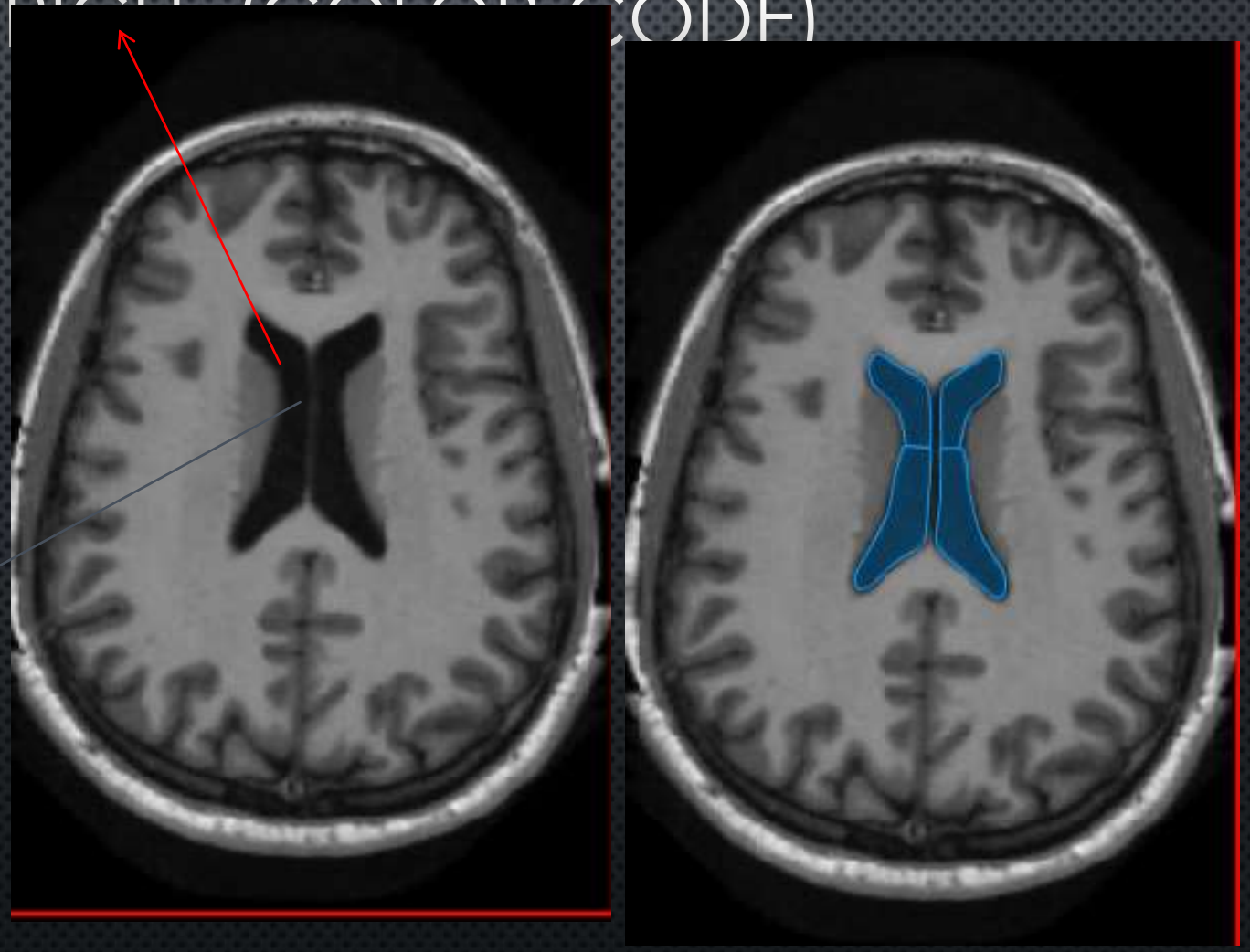

Third ventricle
Aqueduct of Sylvius
Fourth ventricle

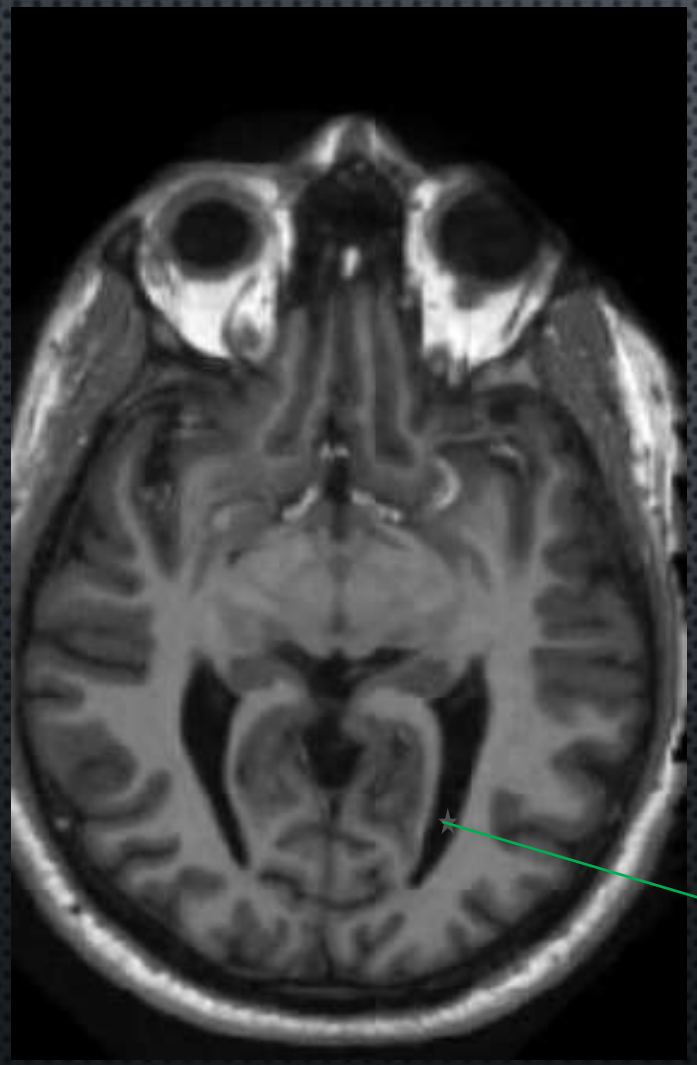

Foramen of Magendie



LATERAL VENTRICLE (COLOR CODE)

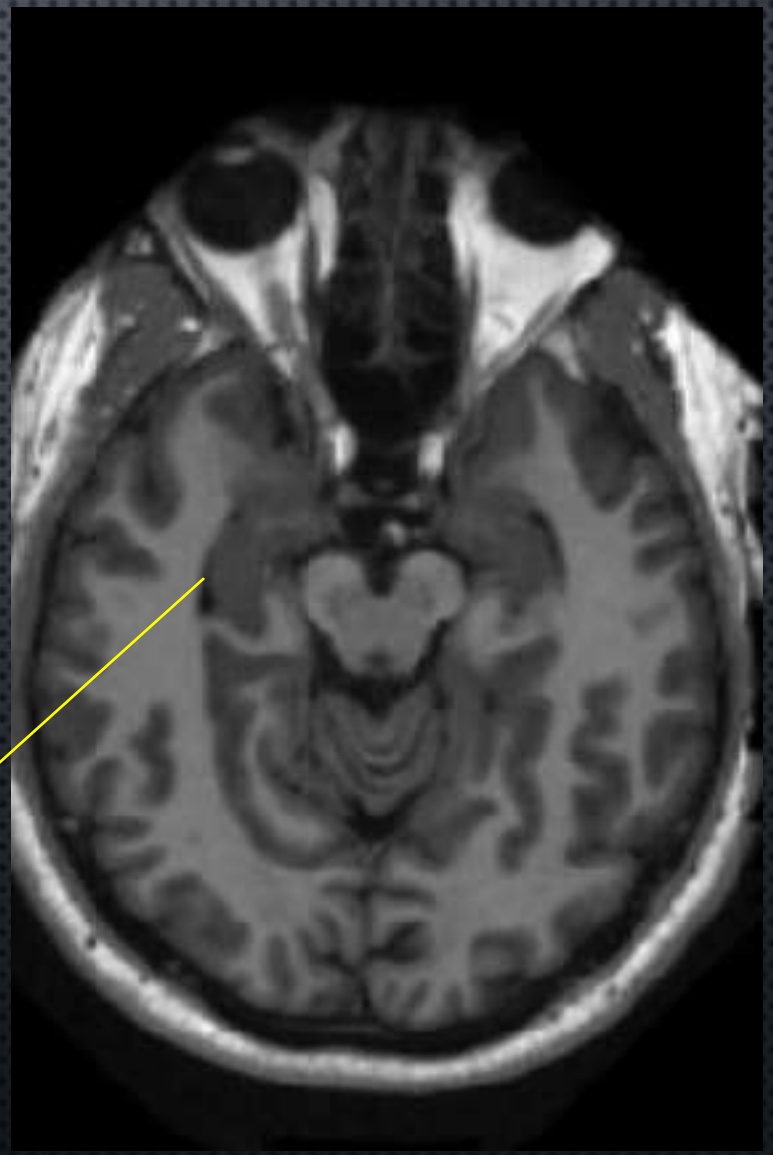
- 1-FRONTAL HORN
- 2-BODY
- 3-TEMPORAL
- HORN
- 4-OCCIPITAL
- HORN



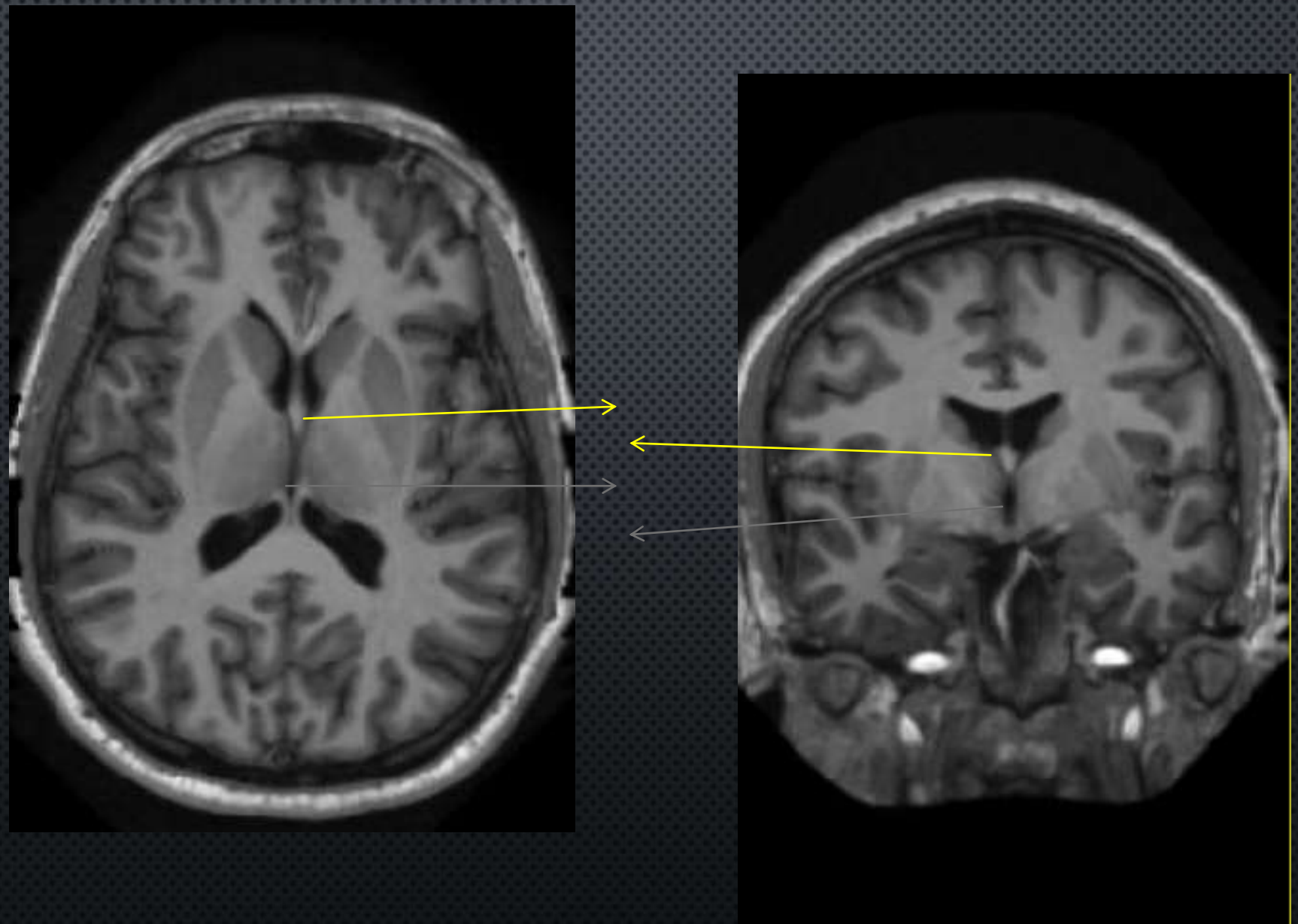


Temporal horn

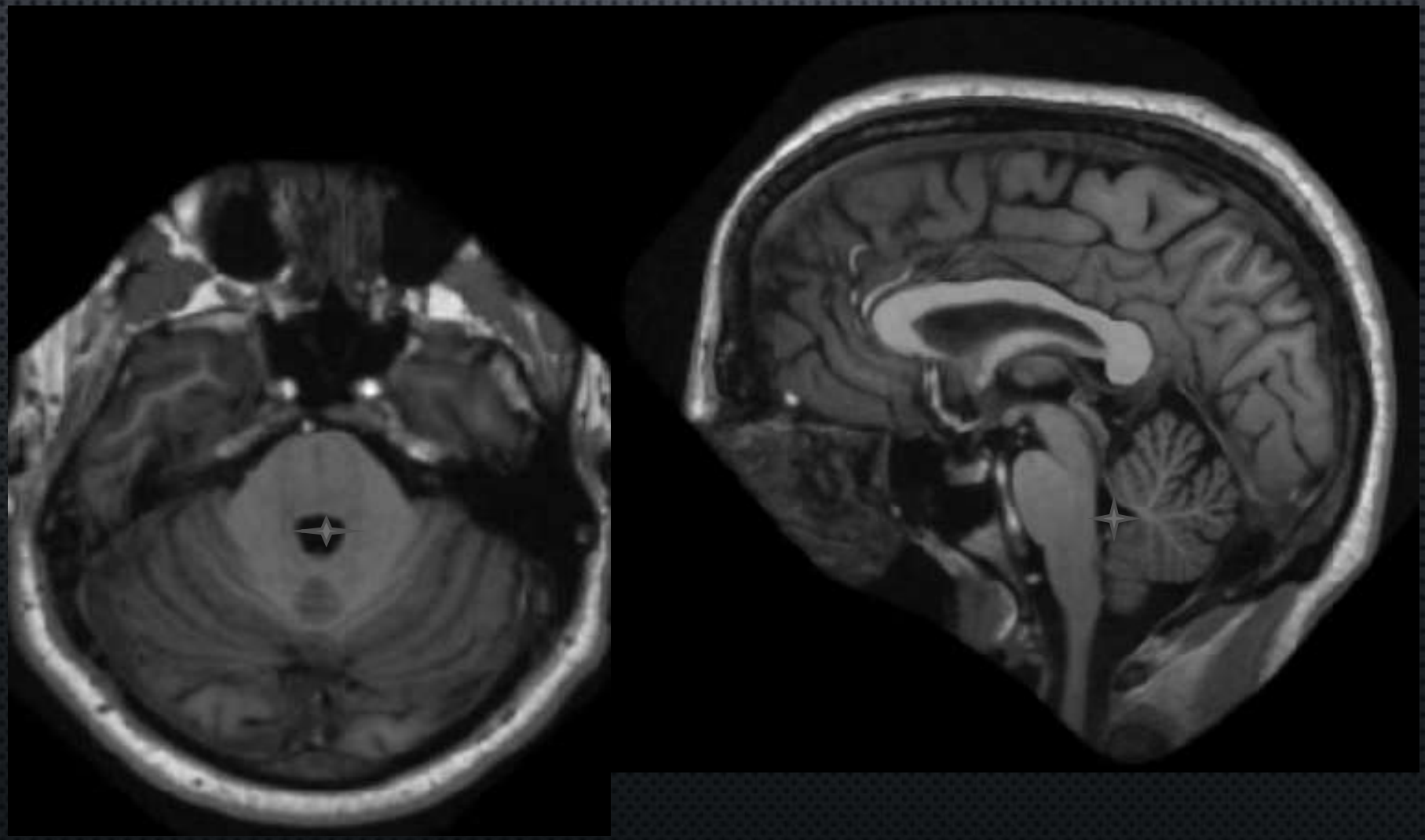
Occipital horn

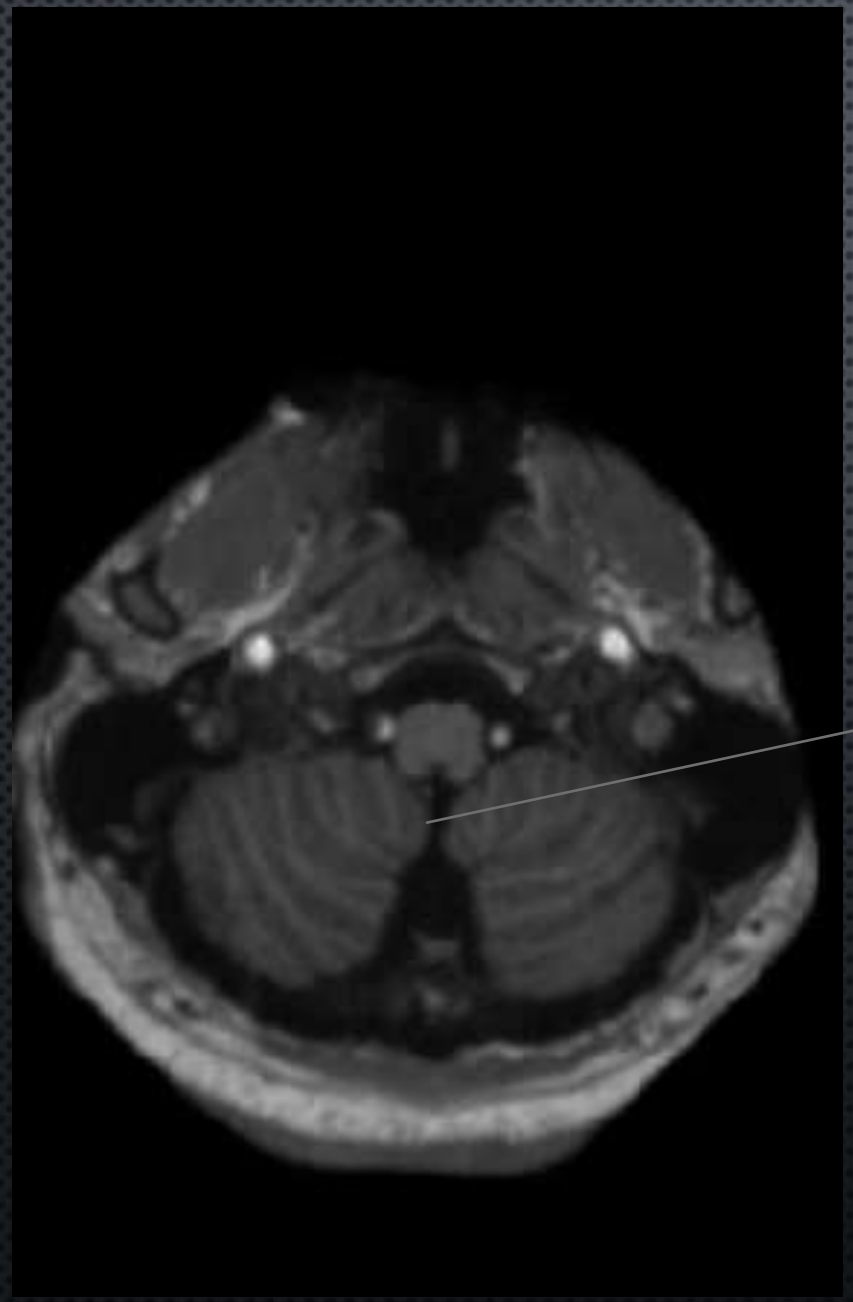


- 1-3RD VENTRICLE
- 2-FORAMEN
- OF MONRO



FOURTH VENTRICLE





FORAMEN OF MAGENDI

SELF ANATOMY EXAMS

EXAM 1

ANSWER EXAM 1

A. Orbit

B. Sphenoid Sinus

C. Temporal Lobe

D. External Auditory Canal

E. Mastoid Air Cells

F. Cerebellar Hemisphere

EXAM 2

ANSWER EXAM 2

A. Frontal Lobe

B. Frontal Bone (Superior Surface of Orbital Part)

C. Dorsum Sellae

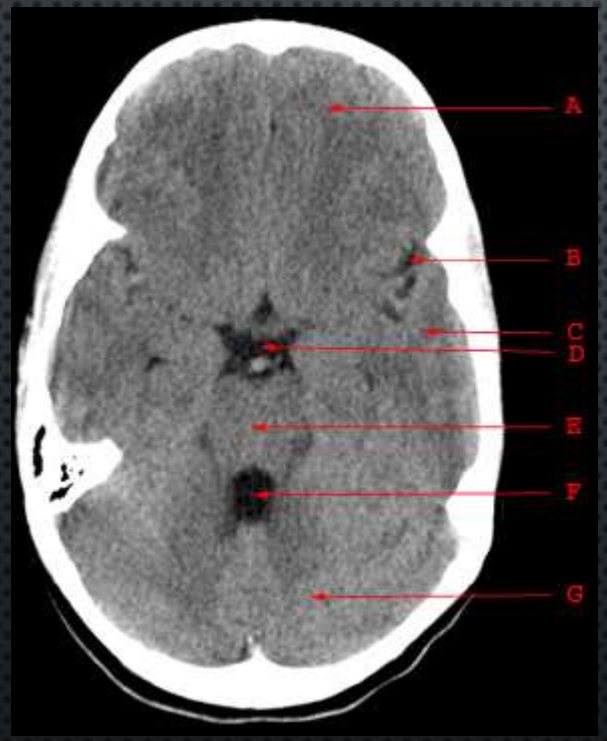
D. Basilar Artery

E. Temporal Lobe

F. Mastoid Air Cells

G. Cerebellar Hemisphere

EXAM 3



ANSWERER EXAM 3

A. Frontal Lobe

B. Sylvian Fissure

C. Temporal Lobe

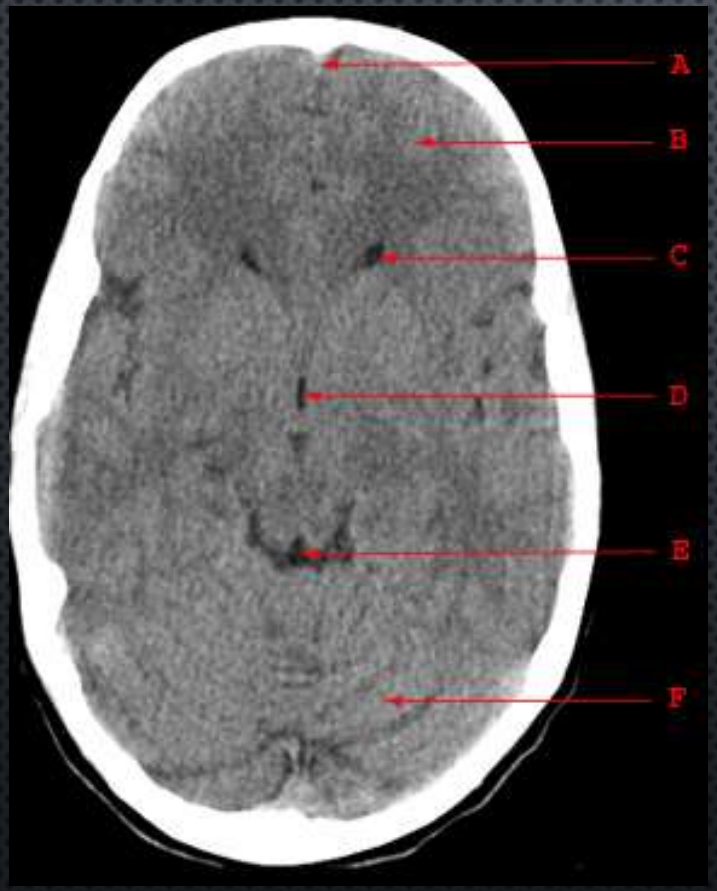
D. Suprasellar Cistern

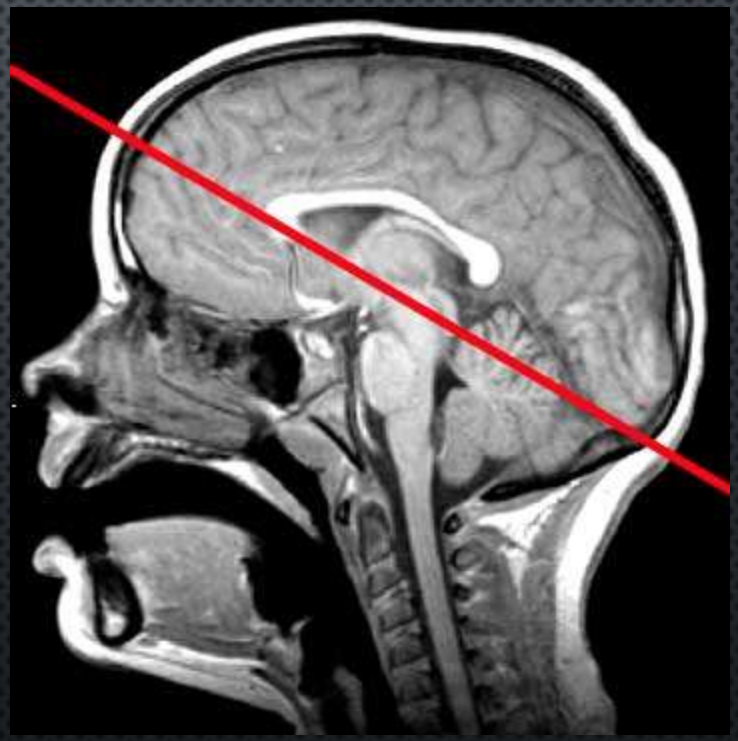
E. Midbrain

F. Fourth Ventricle

G. Cerebellar Hemisphere

EXAM 4





ANSWER EXAM 4

A. Falx Cerebri

B. Frontal Lobe

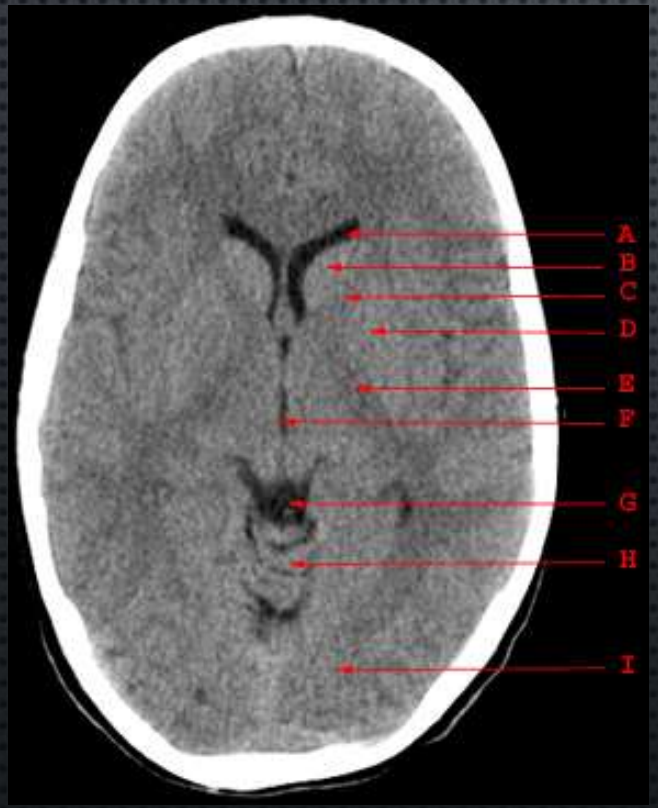
C. Anterior Horn of Lateral Ventricle

D. Third Ventricle

E. Quadrigeminal Plate Cistern

F. Cerebellum

EXAM 5



ANSWER 5

A. Anterior Horn of the Lateral Ventricle

B. Caudate Nucleus

C. Anterior Limb of the Internal Capsule

D. Putamen and Globus Pallidus

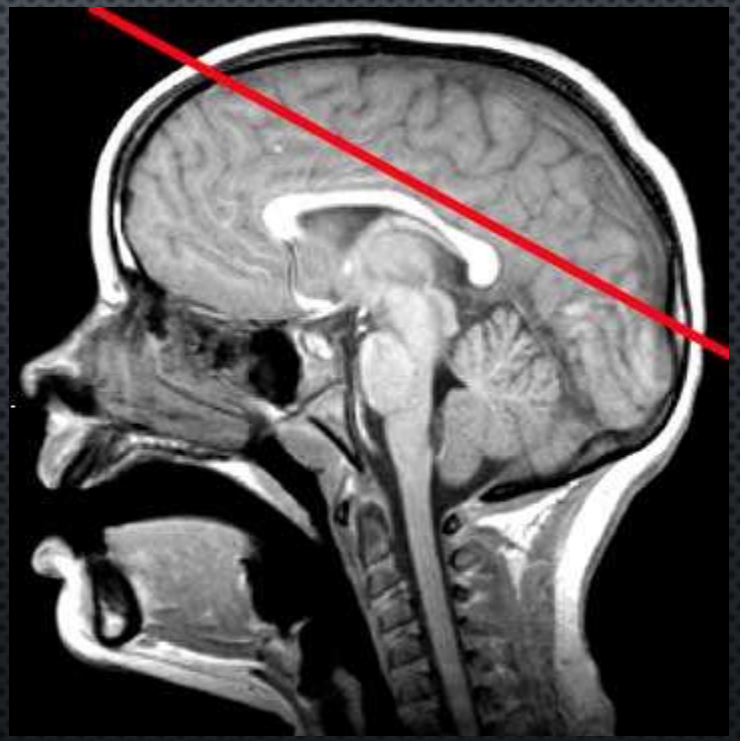
E. Posterior Limb of the Internal Capsule

F. Third Ventricle

G. Quadrigeminal Plate Cistern

H. Cerebellar Vermis

EXAM6



ANSWER 6

A. Falx Cerebri

B. Frontal Lobe

C. Body of the Lateral Ventricle

D. Splenium of the Corpus Callosum

E. Parietal Lobe

F. Occipital Lobe

G. Superior Sagittal Sinus

EXAM 7

ANSWER 7

A. Falx Cerebri

B. Frontal Lobe

C. Body of the Lateral Ventricle

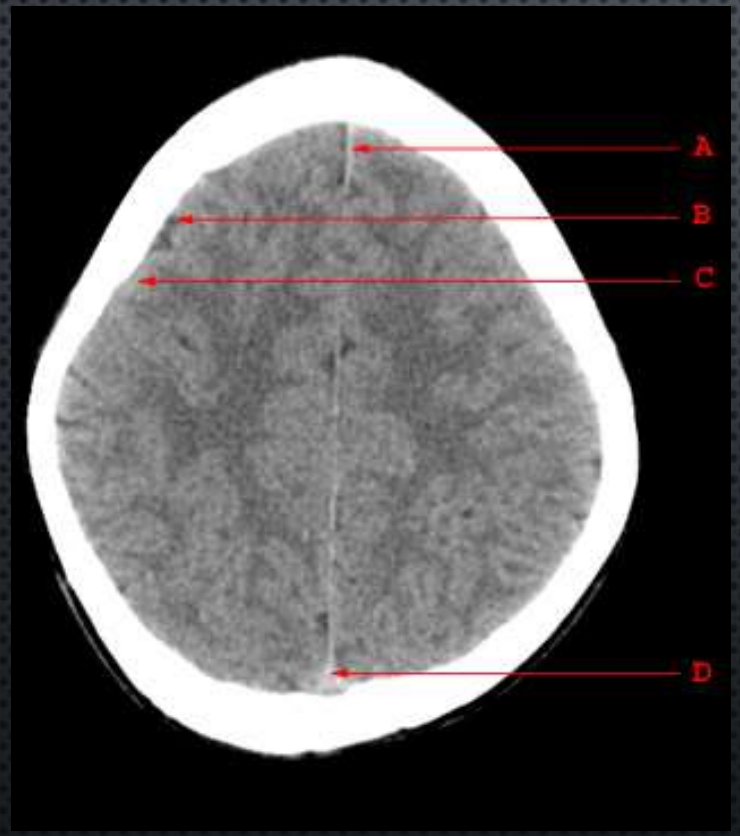
D. Splenium of the Corpus Callosum

E. Parietal Lobe

F. Occipital Lobe

G. Superior Sagittal Sinus

EXAM 8



ANSWER 8

A. Falx Cerebri

B. Sulcus

C. Gyrus

D. Superior Sagittal Sinus