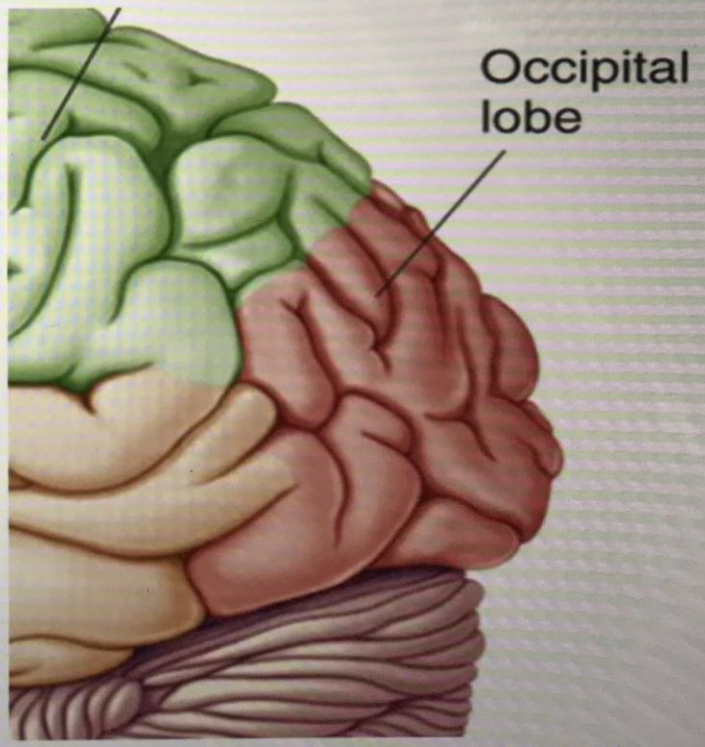
ΙΝΙΑΚΟΣ ΛΟΒΟΣ

ΙΩΑΝΝΗΣ ΜΑΓΡΑΣ
ΝΕΥΡΟΧΕΙΡΟΥΡΓΟΣ
ΑΝΑΠΛΗΡΩΤΗΣ ΚΑΘΗΓΗΤΗΣ ΑΠΘ

Lobes of the Brain – Occipital Lobe

- The Occipital Lobe of the Brain is located deep to the Occipital Bone of the Skull.

- Its primary function is the processing, integration, interpretation, etc. of VISION and visual stimuli.



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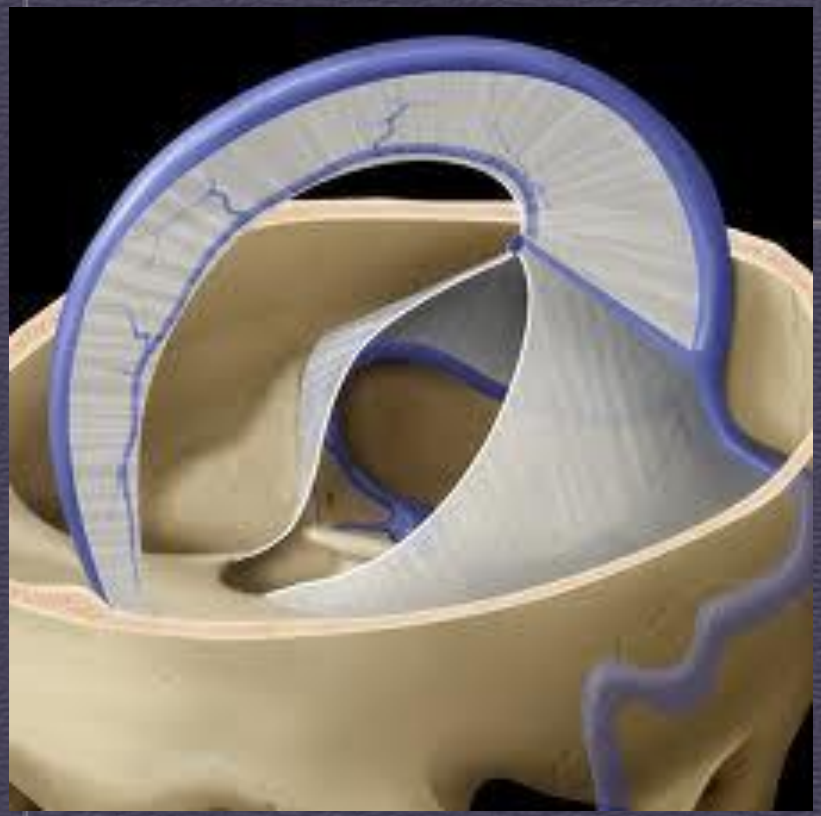
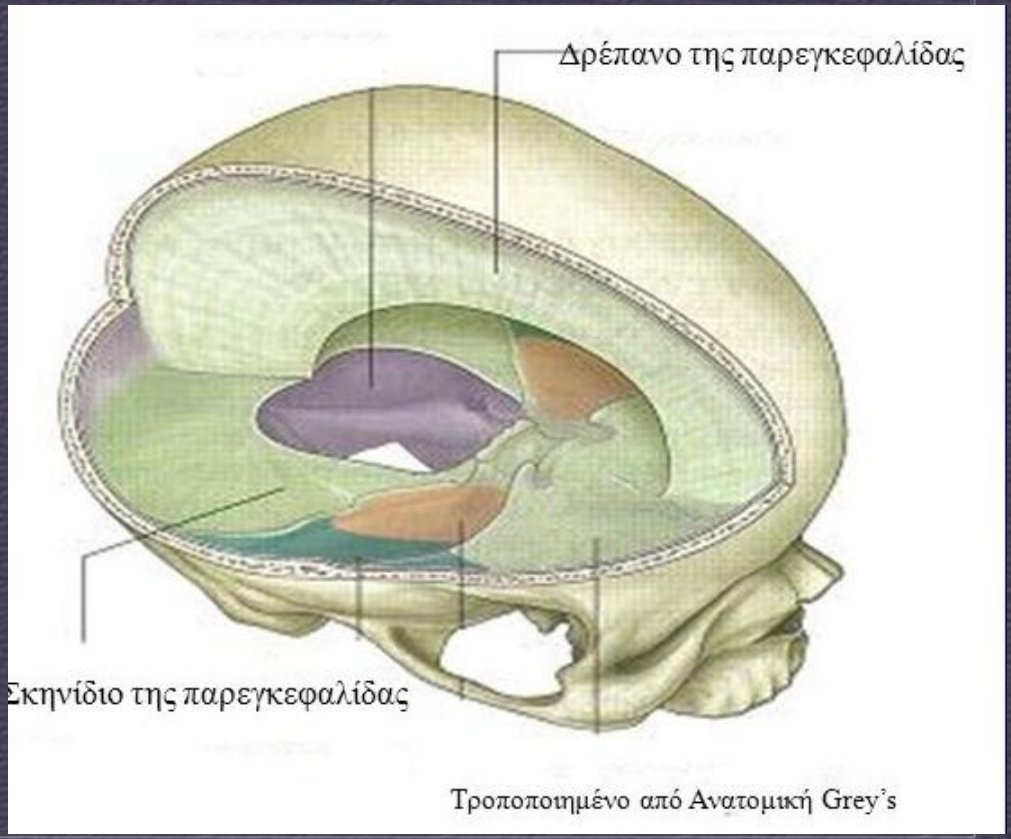
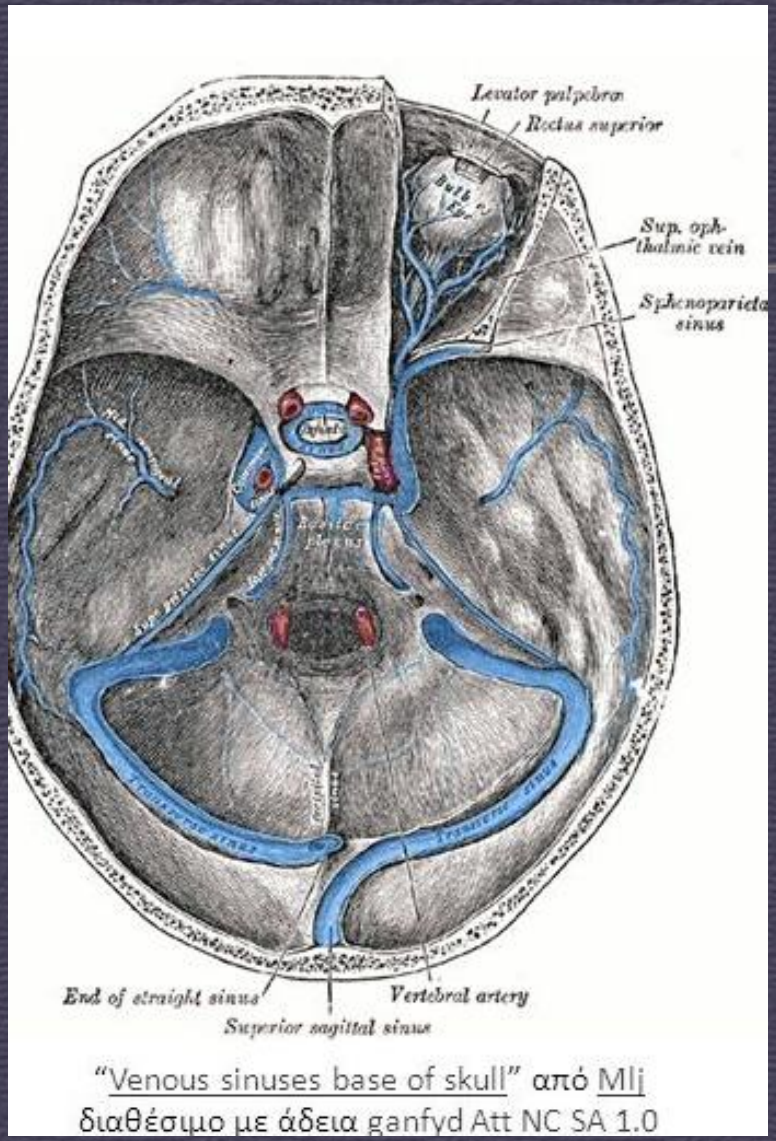
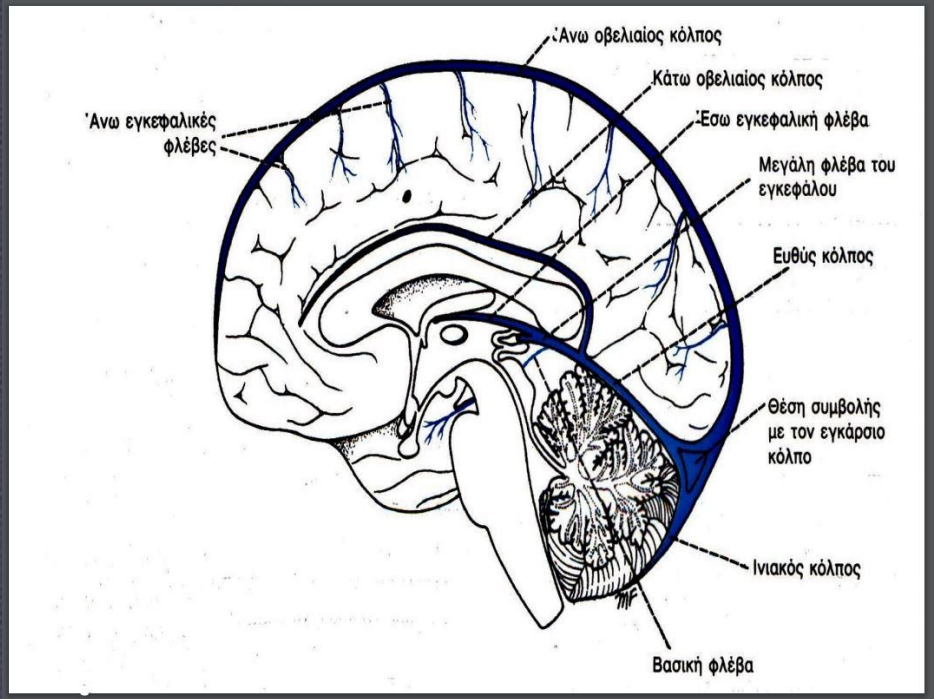


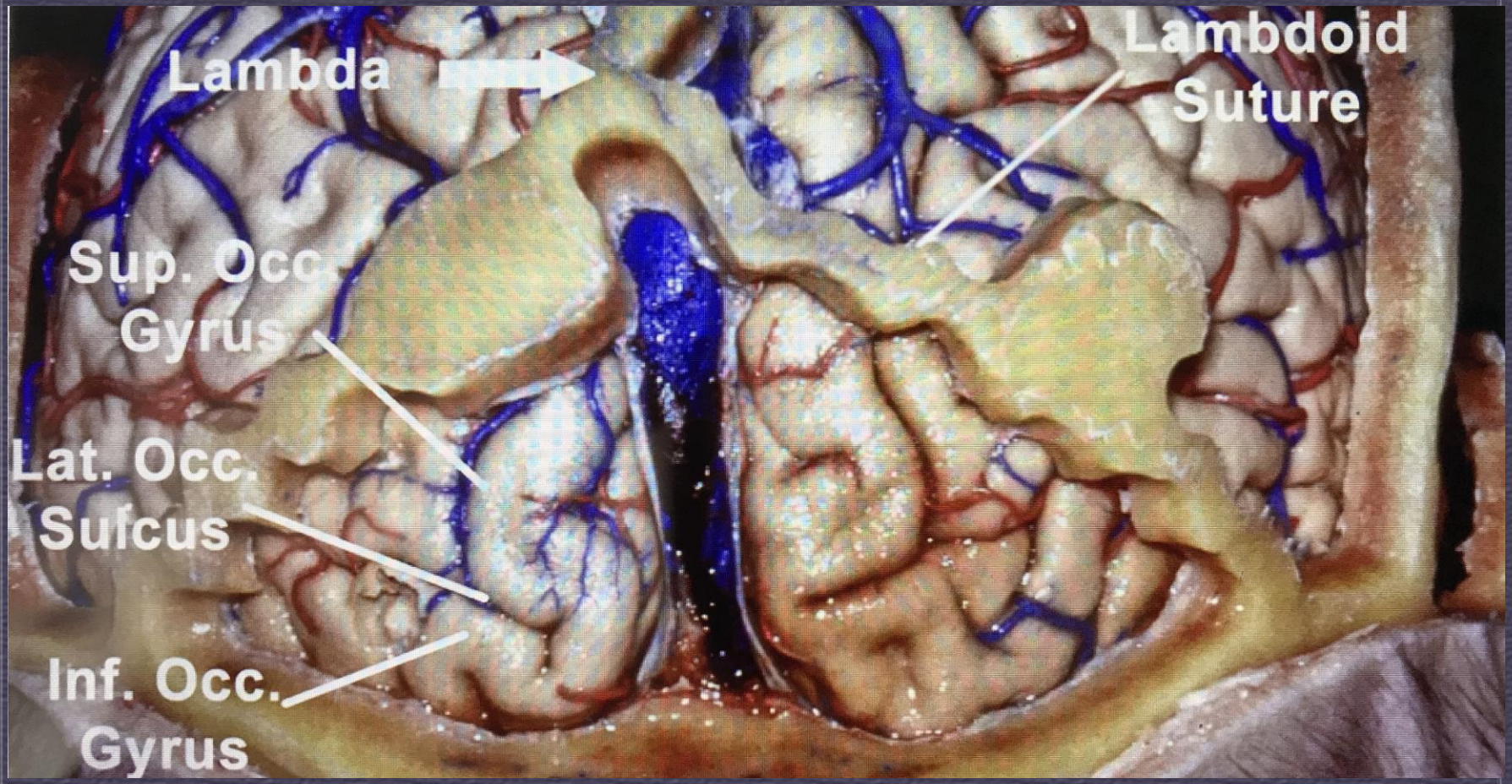


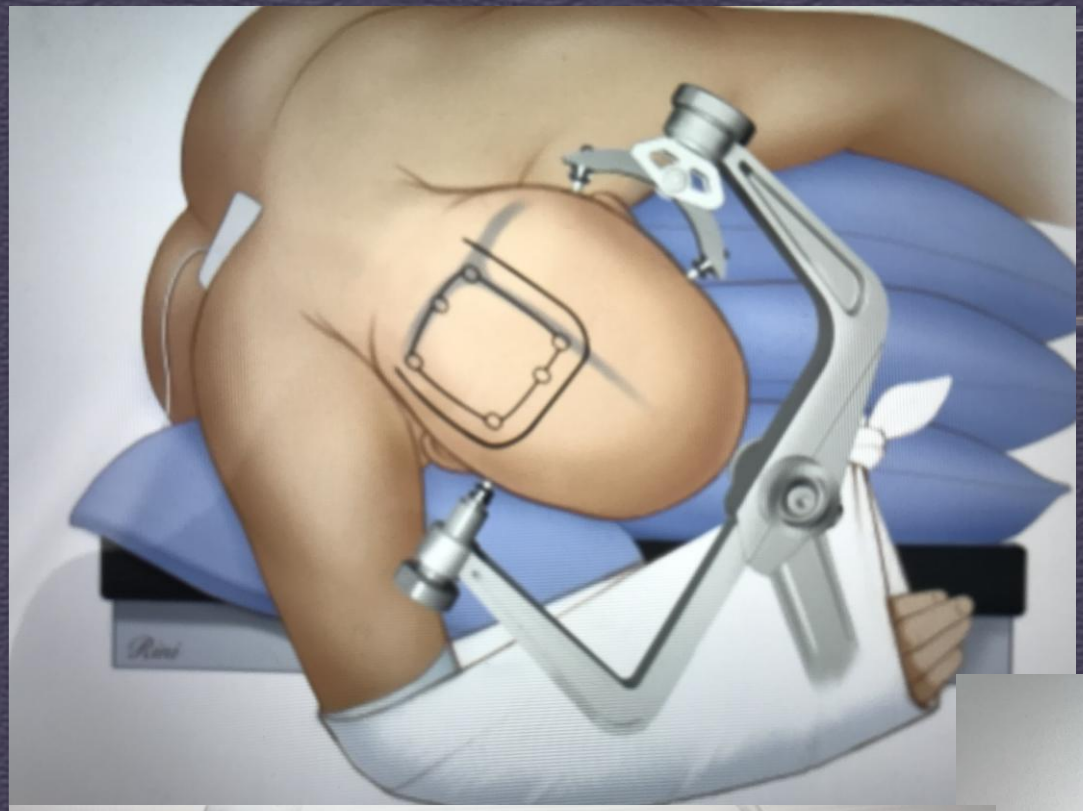
Τροποποιημένο από Ανατομική Grey's

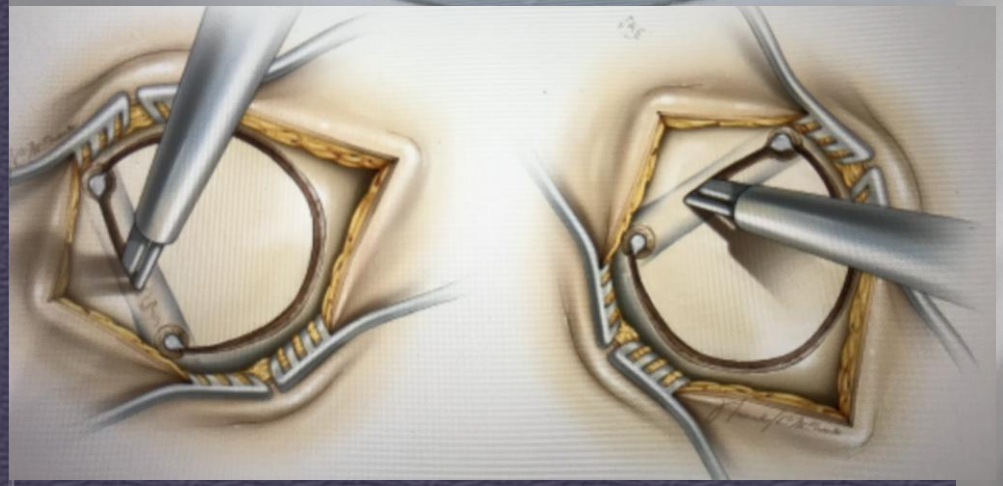


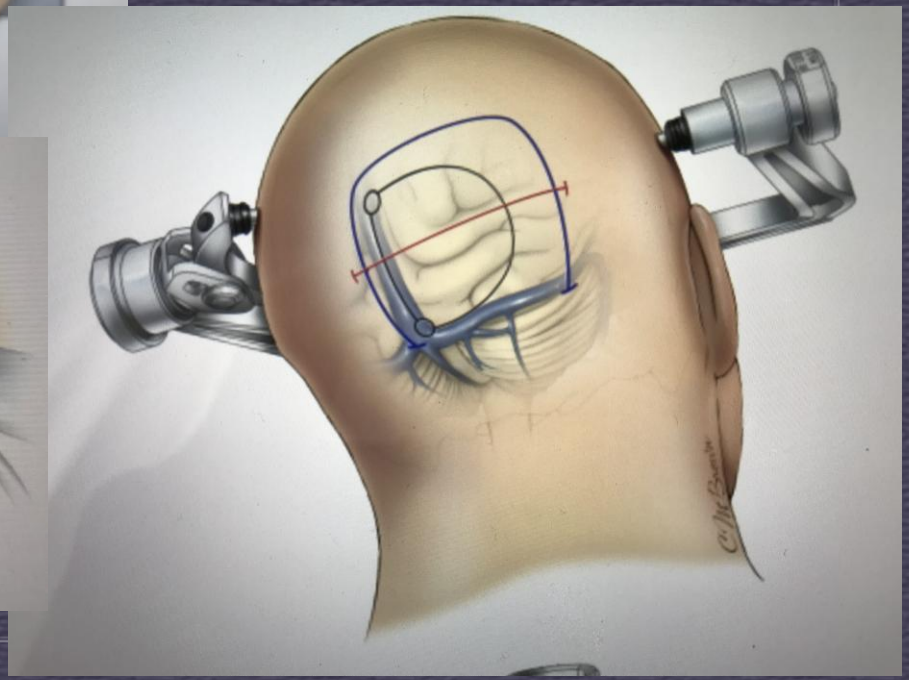
"Venous sinuses base of skull" από Mlj διαθέσιμο με άδεια ganfyd Att NC SA 1.0

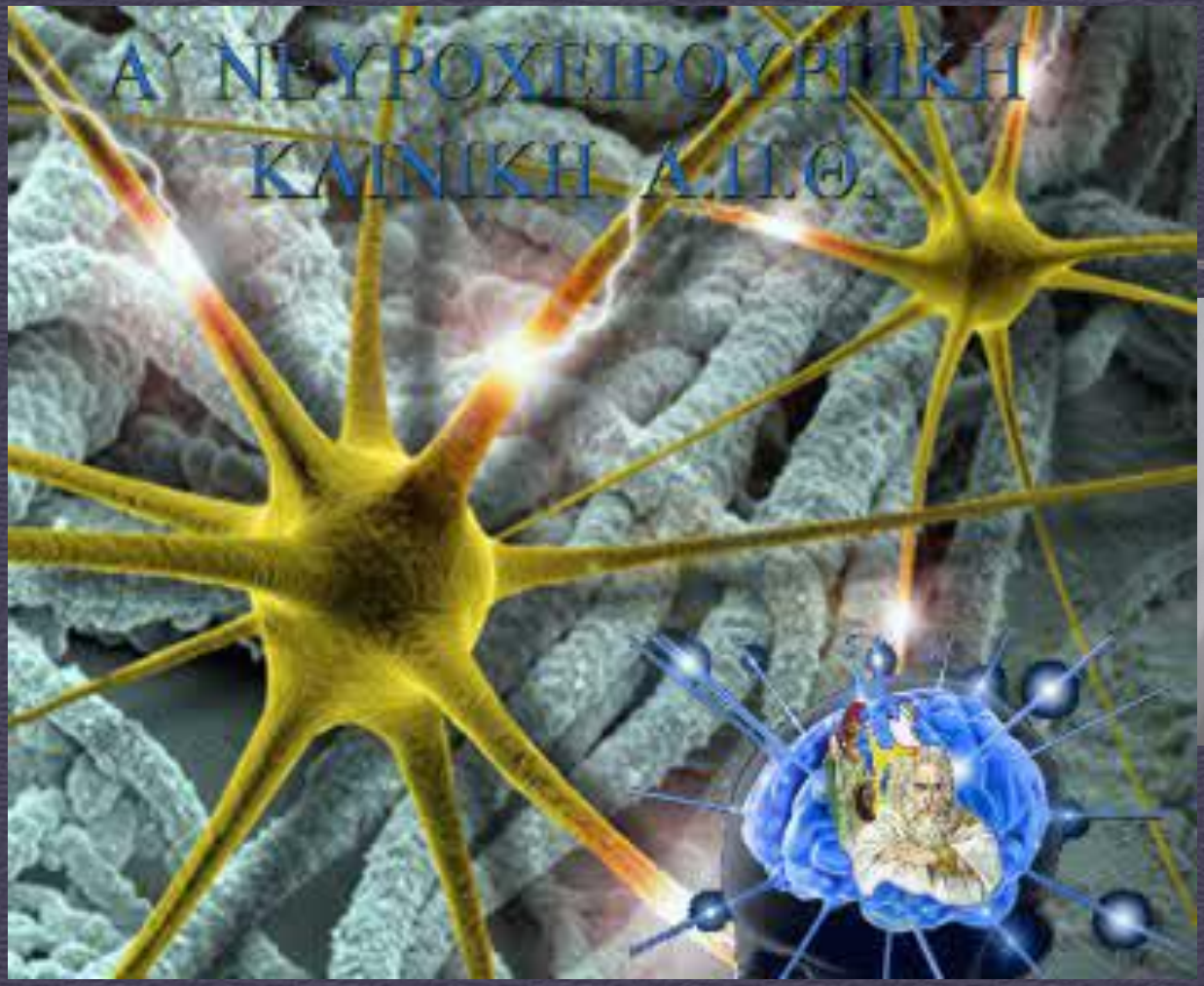


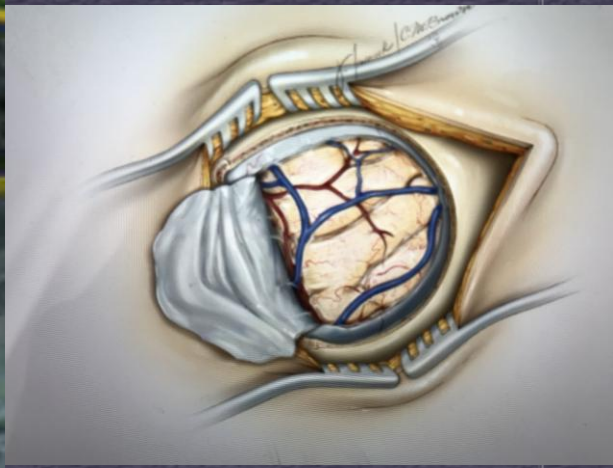

Lambda
Lambdoid Suture
Sup. Occ. Gyrus
Lat. Occ. Sulcus
Inf. Occ. Gyrus





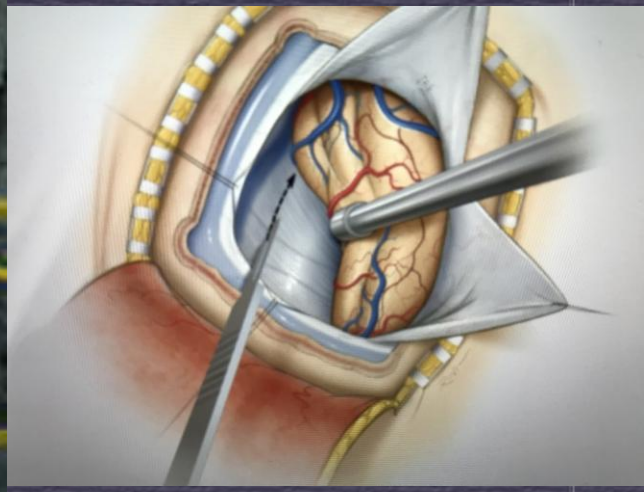


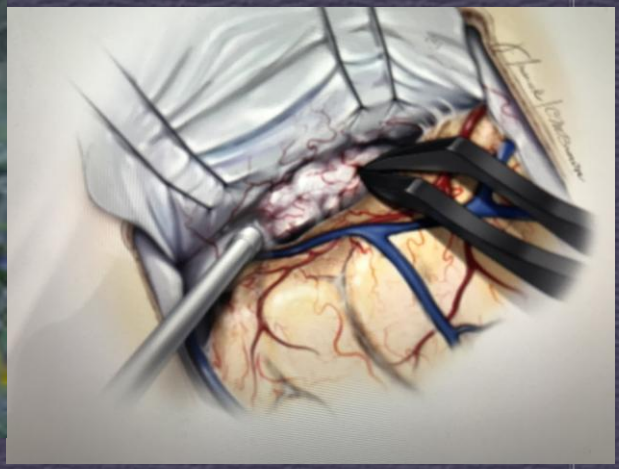




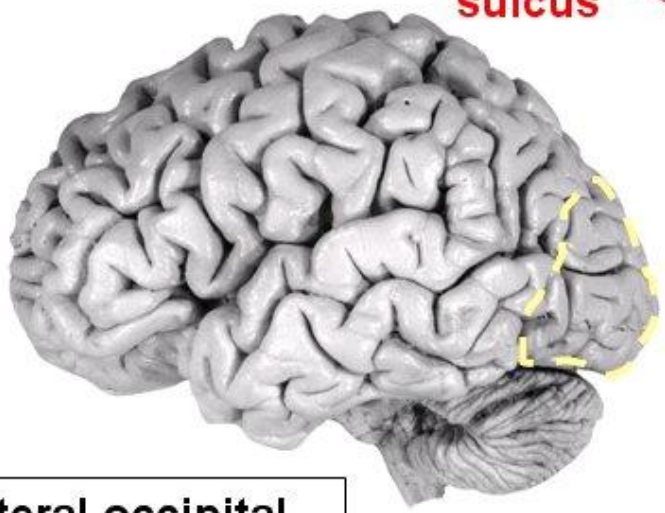
opening.mpg

Α΄ ΝΕΥΡΟΧΕΙΡΟΥΡΓΙΚΗ ΚΛΙΝΙΚΗ Α.Π.Θ.





Occipital lobe and visual pathways



Γωνιώδης ελικα

Angular gyrus

Superior temporal sulcus

Lateral occipital gyri

Preoccipital notch

Parieto occipital fissure

Βρεγματοινιακή σχισμή

39

Transverse occipital sulcus

19

Εγκαρσία ινιακή αυλακα

18

17

19

18

Lateral occipital sulcus

Εξω ινιακή αυλακα

Lunate sulcus

Μηνοειδής αυλακα

Lateral occipital gyri are not always very well defined. They are in relation with the variations of the lateral occipital sulci.

Occipital lobe and visual pathways

Βρεγμοτοινιακη σχισμή

Calcarine sulcus

πληκτραία

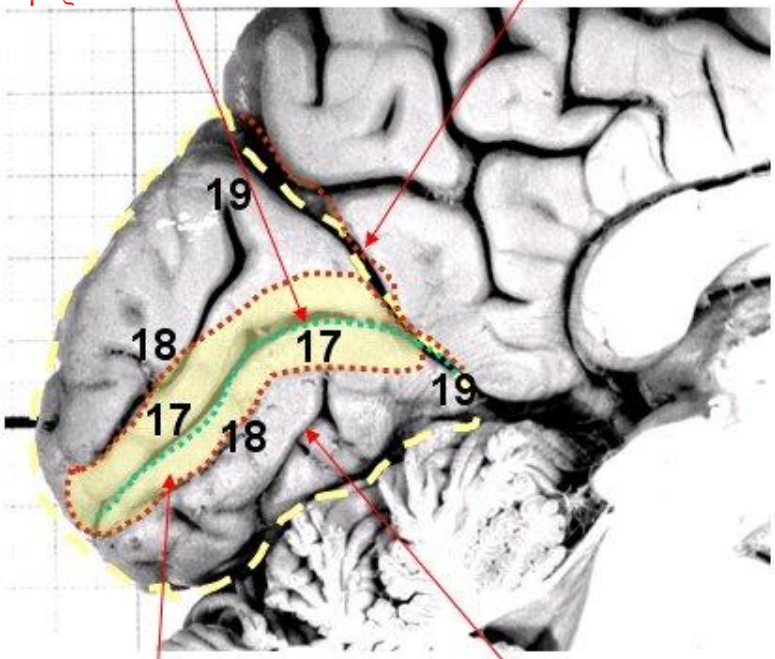
Parieto occipital fissure

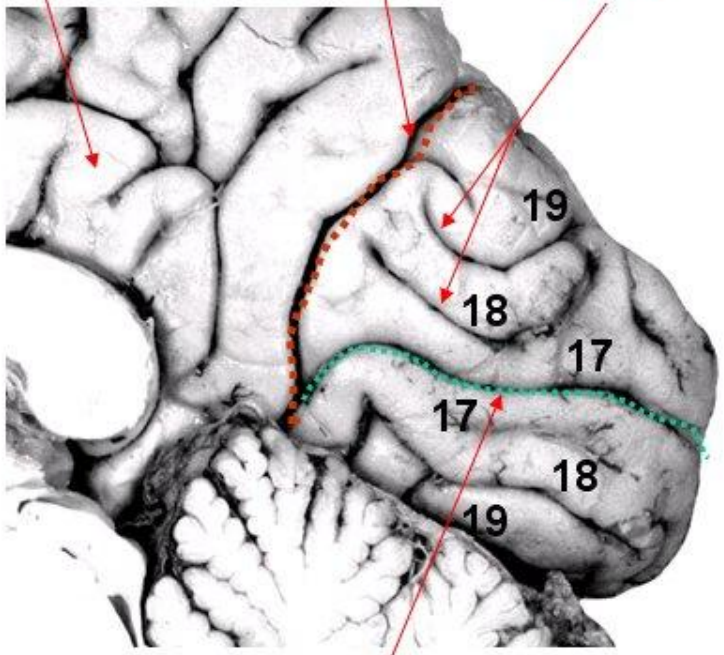
Cingulate gyrus

Ελικα του προσαγωγίου

Parieto occipital fissure

Sagittal sulci





Primary visual area

Lingual sulcus

Calcarine sulcus

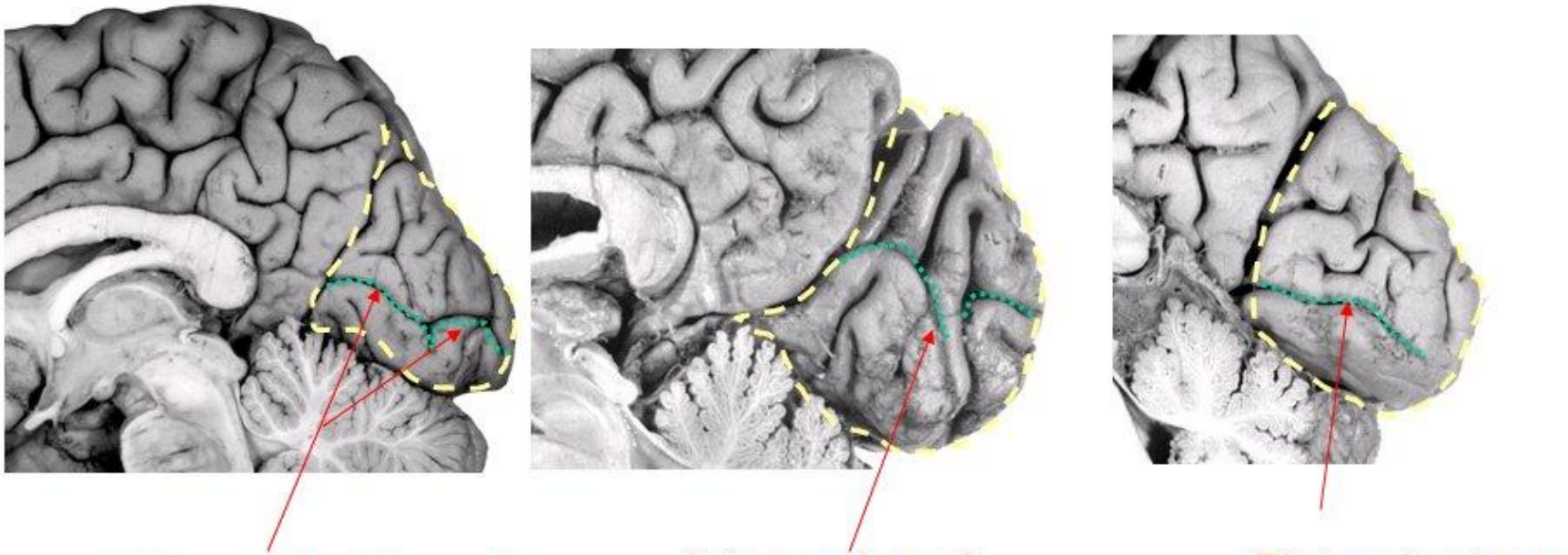
Left

Medial View

Right

Occipital lobe and visual pathways

Different patterns of calcarine fissure



Pattern "double peak"

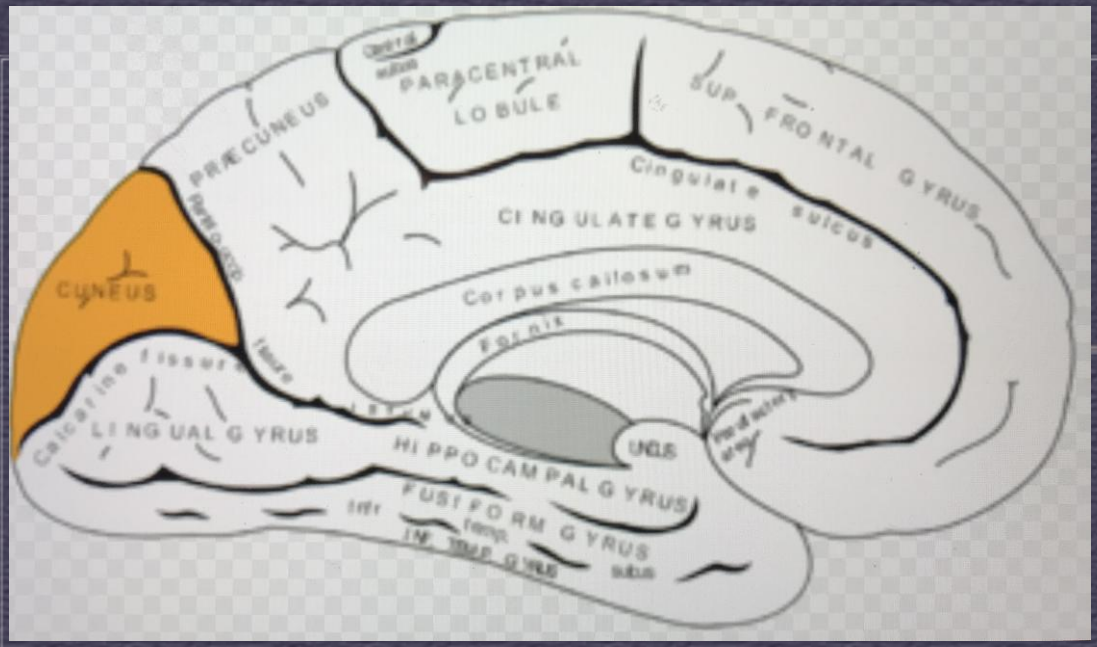
Interruption of calcarine fissure

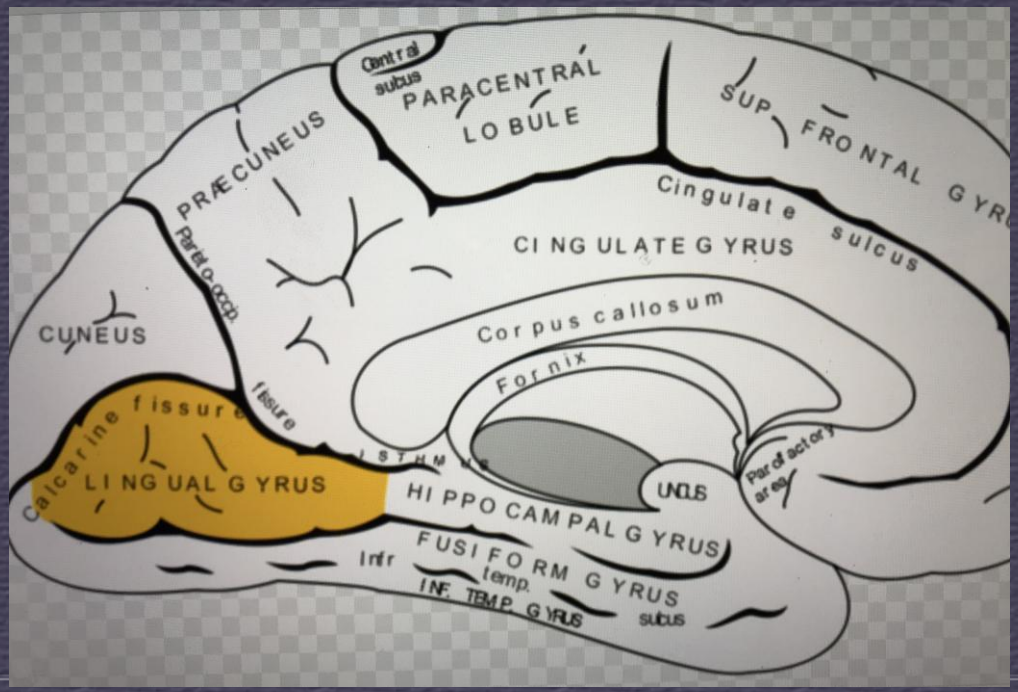
Plateau's shape

For a detailed study of the variations of the calcarine fissure: Chapter 14 in M.Ono, St. Kubik, Ch. Abernathey. Atlas of the cerebral sulci. G.Thieme. 1990

σφηνοειδες λοβιο

γλωσσοειδης ελικα





Occipital lobe and visual pathways

παραπλευρο

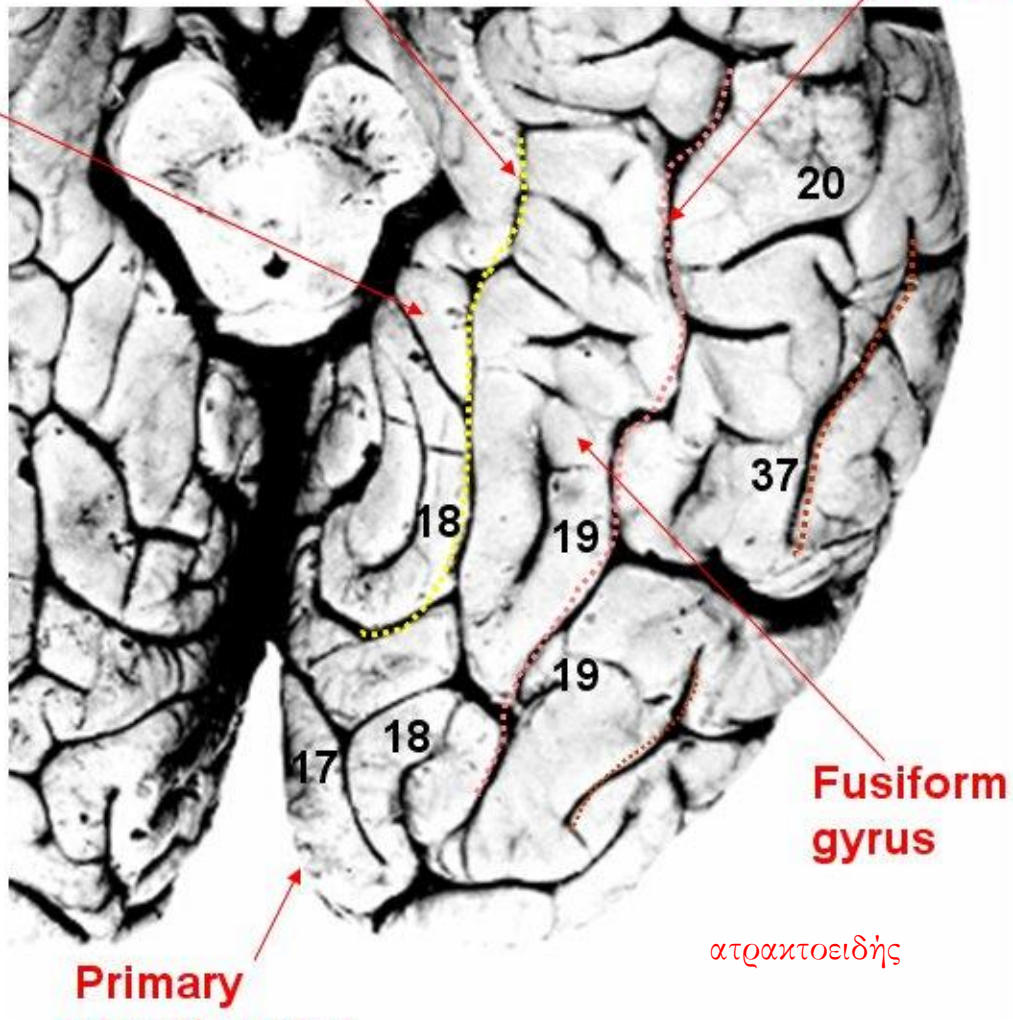
Lingual gyrus

γλωσσοειδής

Inferior View

Collateral sulcus

Temporo occipital sulcus

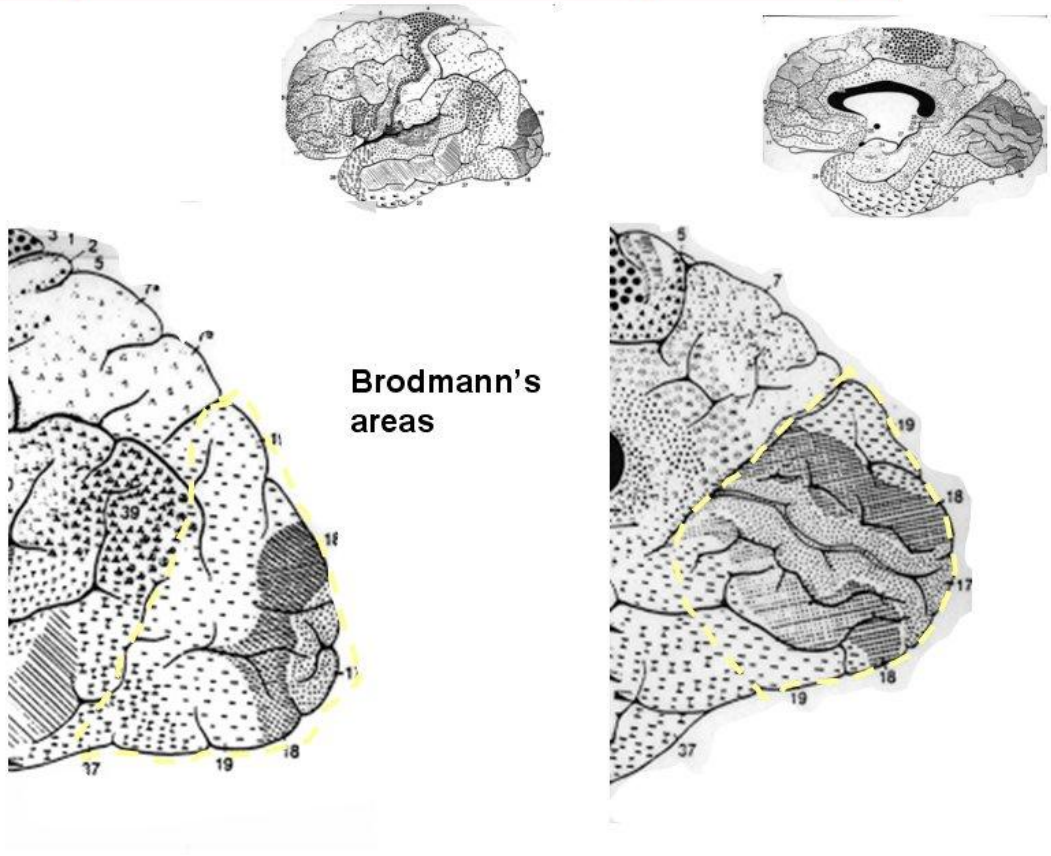


Fusiform gyrus

ατρακτοειδής

Primary visual cortex

Occipital lobe and visual pathways



Ο όρος ***οπτικός φλοιός*** αναφέρεται στον **πρωτοταγή οπτικό** φλοιό (ταινιωτός φλοιός ή περιοχή V1) και στον **εξωταινιωτό φλοιό** δηλαδή σε περιοχές όπως η **V2**, η **V3**, η **V4** και η **V5**. Ο πρωτοταγής οπτικός φλοιός αντιστοιχεί ανατομικά στην περιοχή Brodmann 17 (αλλιώς BA17) και ο **εξωταινιωτός** φλοιός αντιστοιχεί στις περιοχές Brodmann 18 και 19

Οπτική άλως

Ταινιωτή άλως (17) striate area

(καταλήγει η οπτική ακτινοβολία εκ του εξω γονατώδους σώματος Στο πισω μέρος καταλήγουν ινες απο την ωχρά κηλίδα)

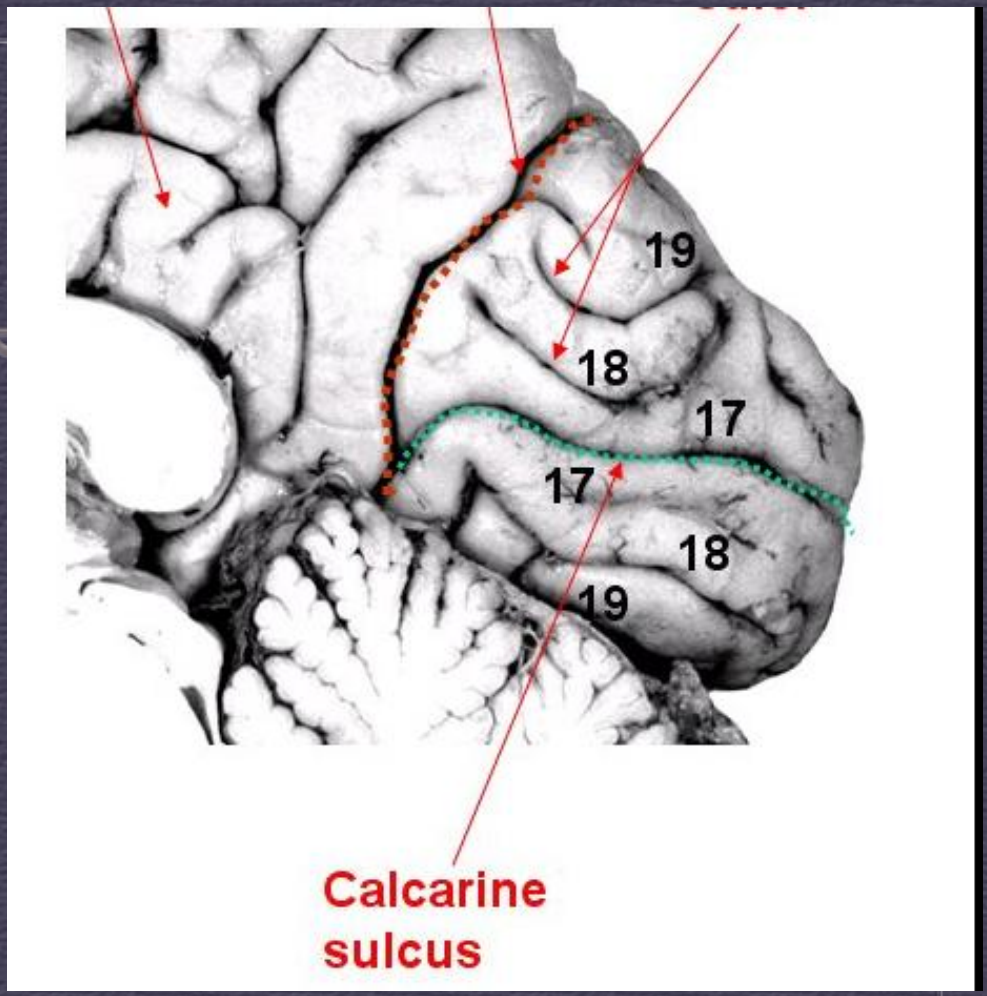
Παραταινιωτή άλως (18) parastriate

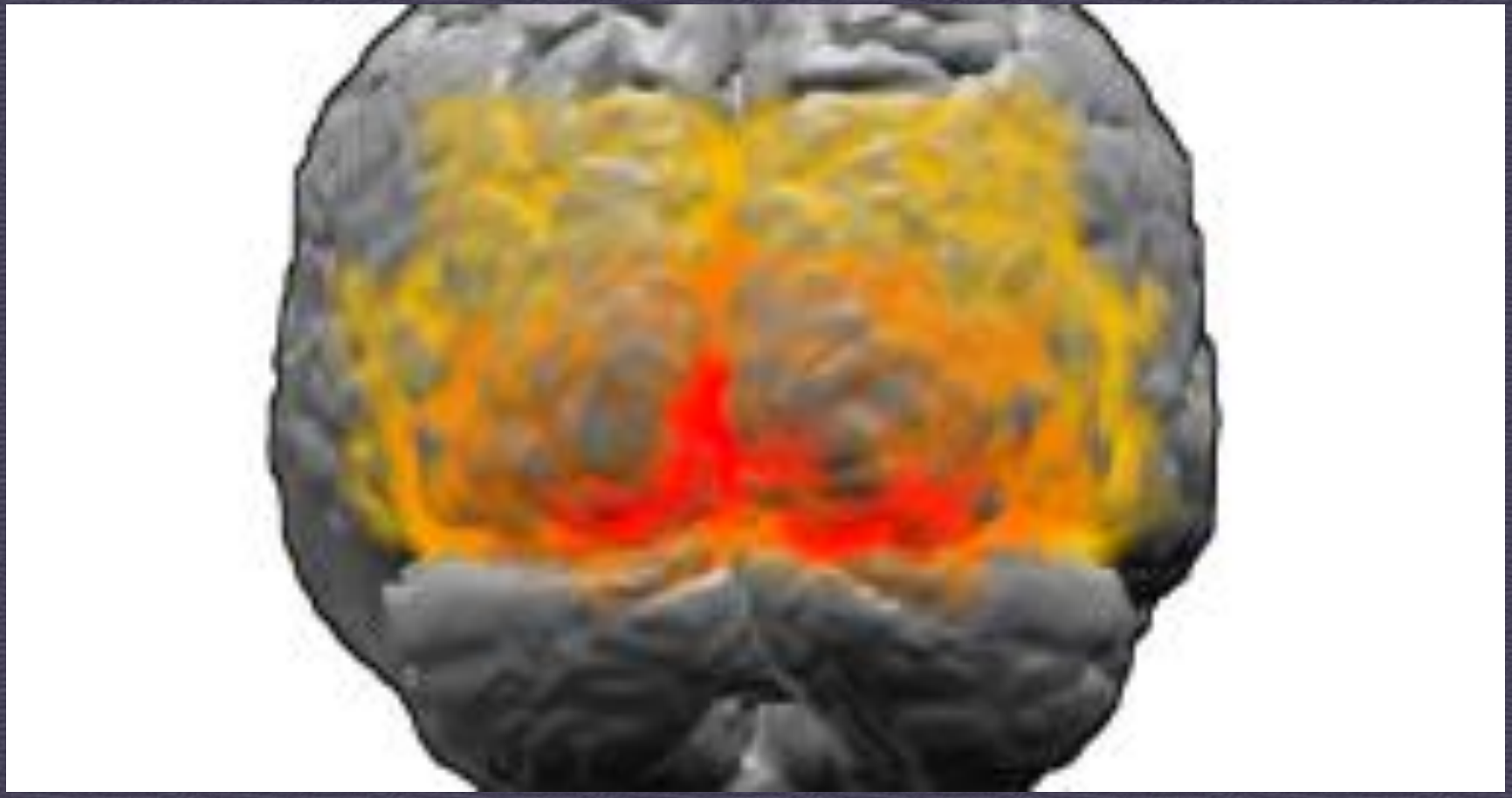
Με το μετωπιαίο οφθαλμικό πεδίο Αντανακλαστικές κινήσεις

Περιταινιωτή άλως (19) peristriate

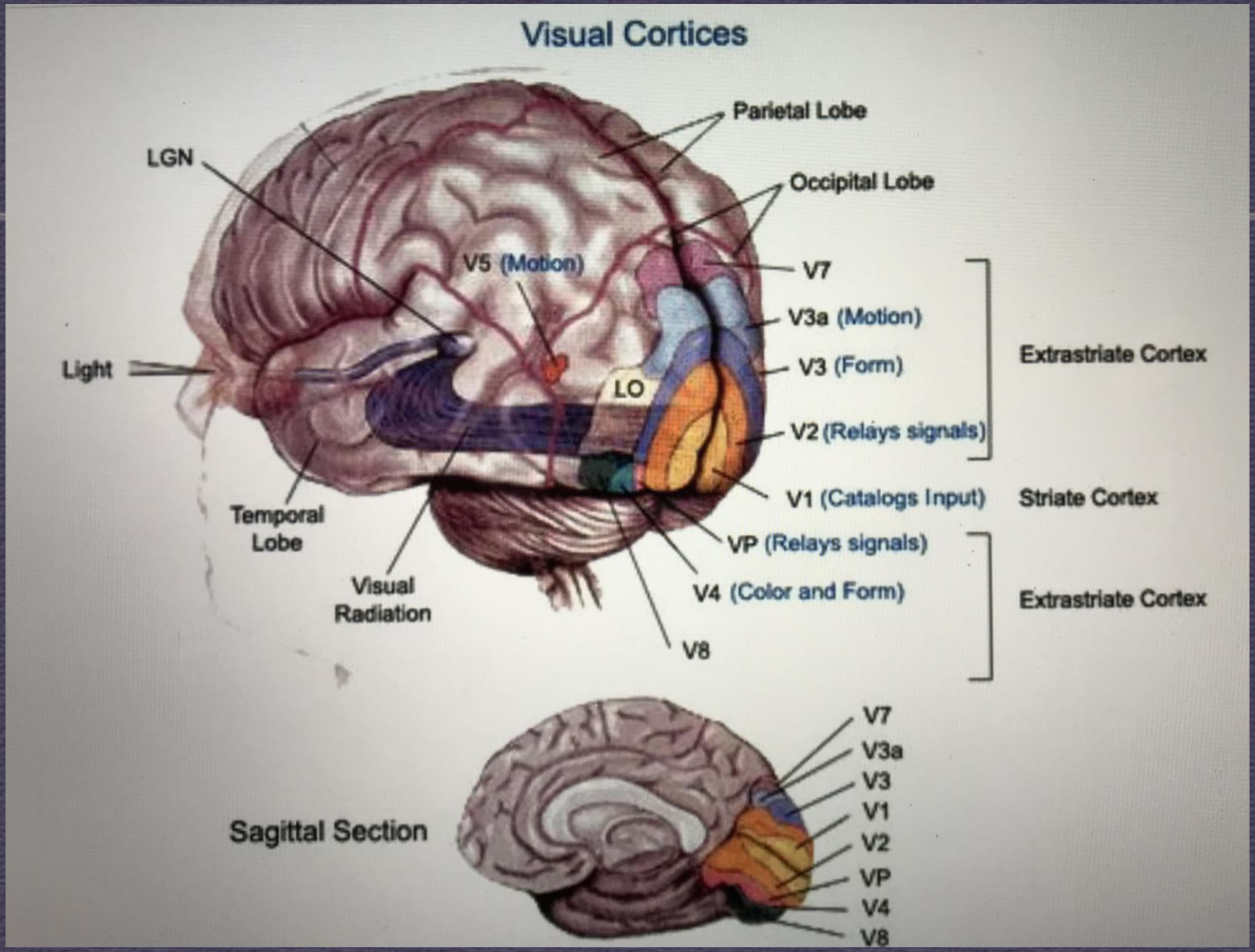
Μνημονικό οπτικό κέντρο δέχεται συνδέσεις από την 18 ανακληση και συγκριση οδηγει σε αναγνωριση αντικειμενων

Σε βλαβη οπτικη αγνωσια



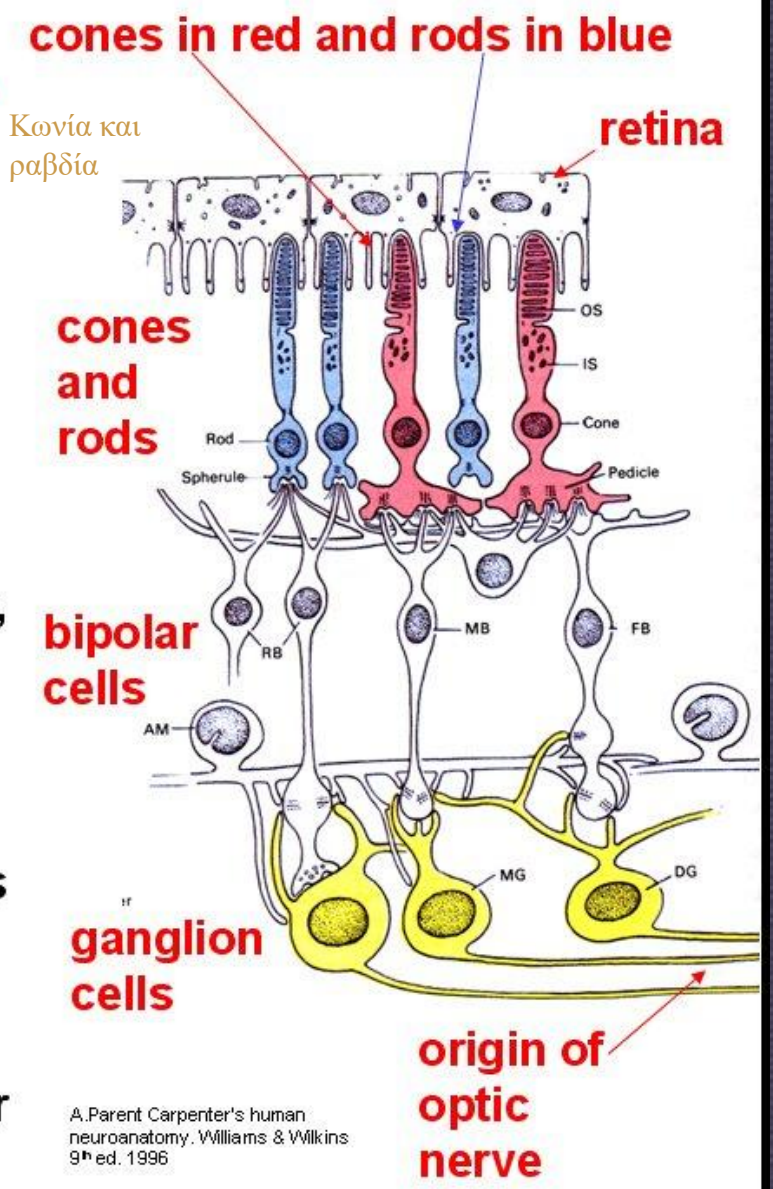


Με κόκκινο φαίνεται η περιοχή Brodmann 17 (πρωτοταγής οπτικός φλοιός) ενώ με πορτοκαλί η περιοχή 18 και με κίτρινο η περιοχή 19


Visual Cortices
Parietal Lobe
LGN
Occipital Lobe
V5 (Motion)
V7
V3a (Motion)
Light
V3 (Form)
LO
Extrastriate Cortex
V2 (Relays signals)
V1 (Catalogs Input)
Striate Cortex
Temporal Lobe
VP (Relays signals)
Visual Radiation
V4 (Color and Form)
Extrastriate Cortex
V8
Sagittal Section
V7
V3a
V3
V1
V2
VP
V4
V8

Visual pathways: Retina

Seven million cones react to light of high intensity and color discrimination. One hundred million rods react to low intensity light or night vision. Rods and cones present the same pattern. The outer segment has a narrow neck, cell body, and a synaptic base spherule for rods or a pedicle for cones. The outer segment of a rod has a specific pigment, rhodopsin, while the cone has three (for blue, red and green). The first relay is the bipolar cell, and the second is the ganglion cell whose axons will form the optic nerve. The retinal ganglion cell has three types. Type X is used for slow conduction, type Y is used for rapid conduction, and a type W is used for slow axons which project to the superior colliculus.

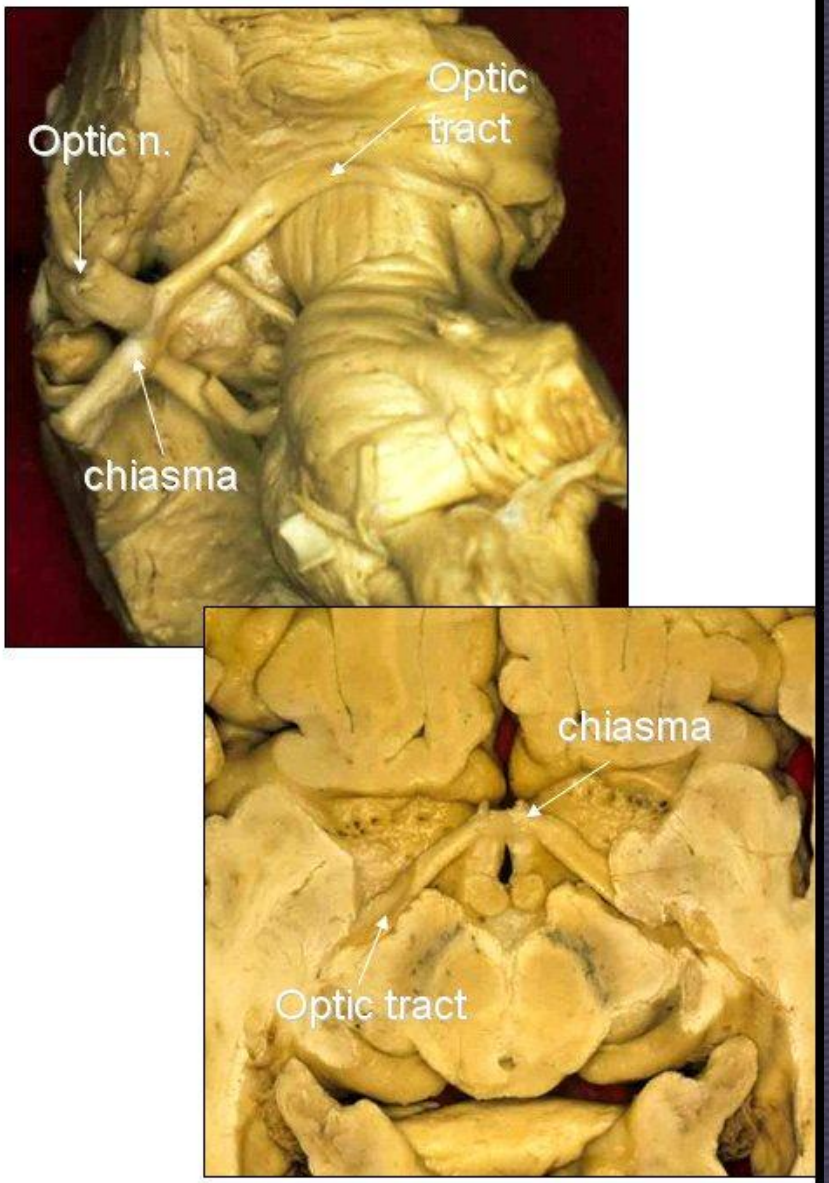


Visual pathways

The optic nerve is a myelinated axon of ganglion cells.

The chiasma is the partial decussation of the optic nerve, with the nasal halves of the retina crossing to the opposite site and fibers of the temporal half being uncrossed.

Optic tract contains the whole opposite field of view: left field for the right tract and the reverse for the left tract. Macula fibers project on both left and right sides. The great majority of optic fibers terminate at lateral geniculate body level and some at the superior colliculus level.



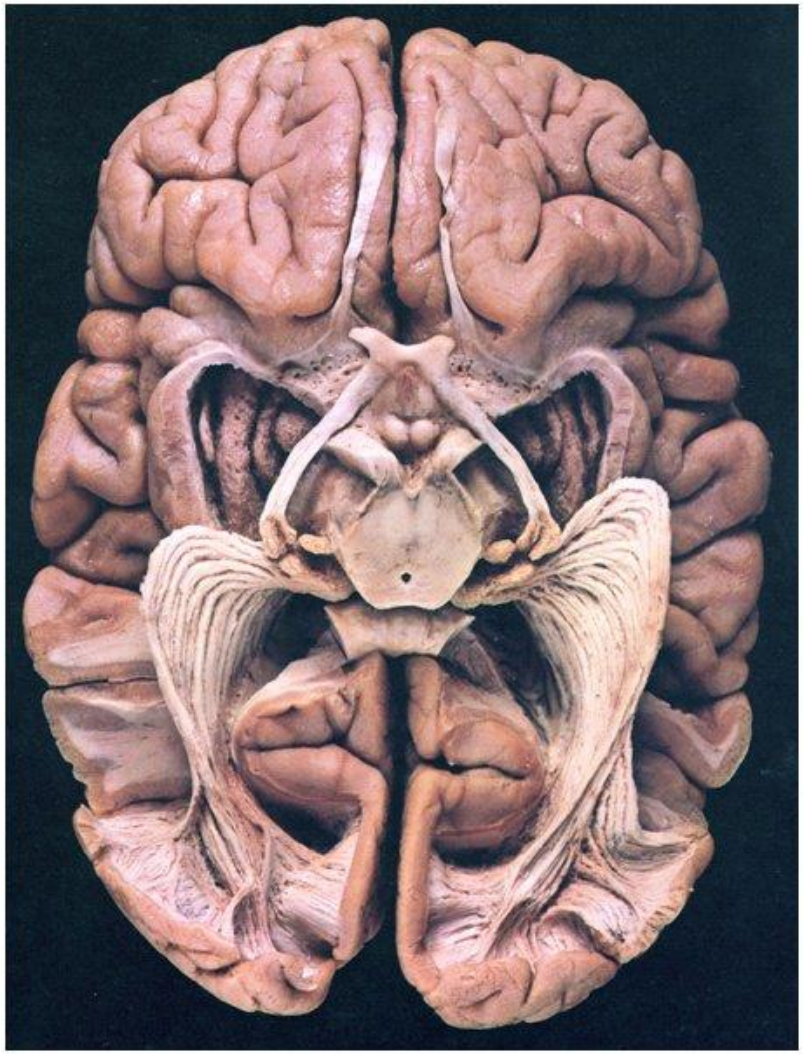
Occipital lobe and visual pathways

Optic radiations: the geniculo calcarine tract arises from the dorsal geniculate and passes through the retro lenticular part of internal capsule.

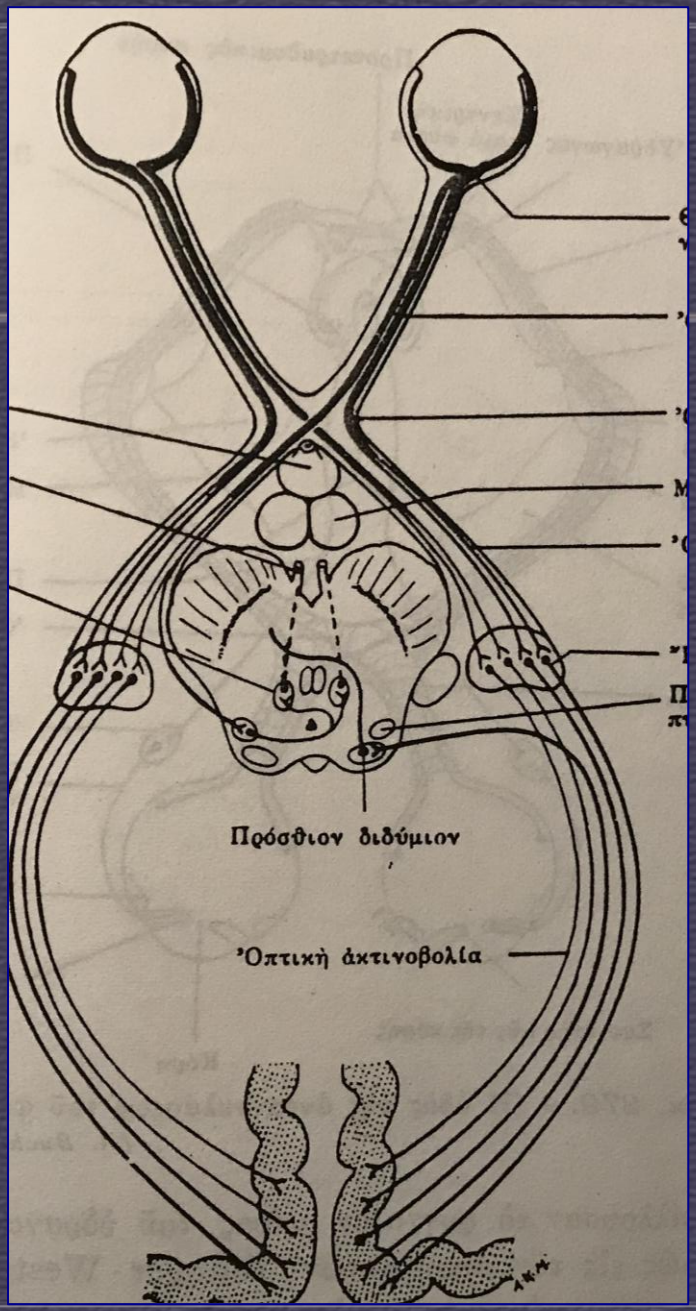
The upper retinal quadrant (lower field of view) projects to the superior lip of the calcarine fissure.

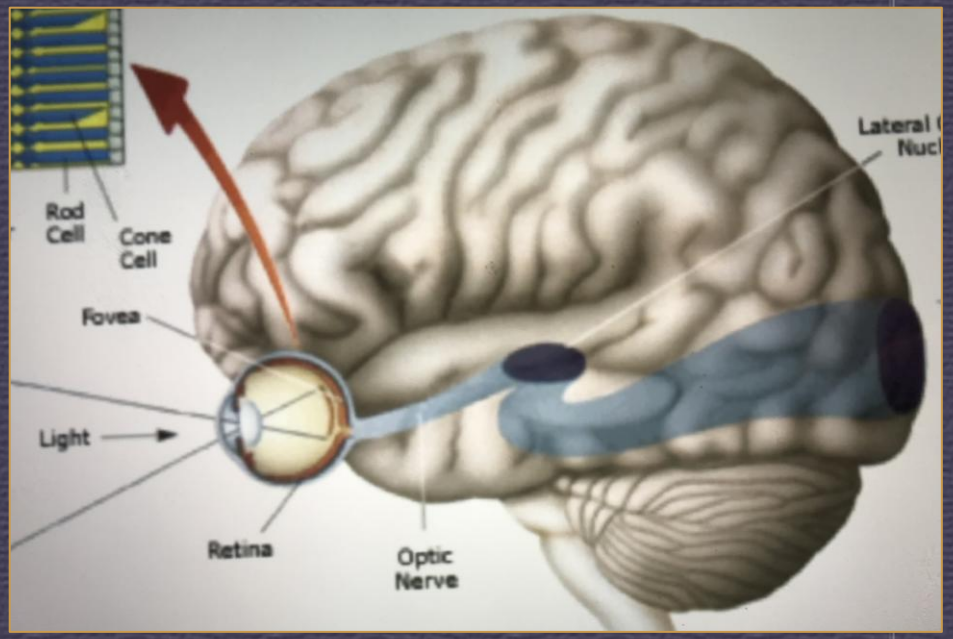
The lower retinal quadrant (superior field of view) projects to the inferior lip of the calcarine fissure.

Macula fibers terminate in the caudal third of calcarine fissure.



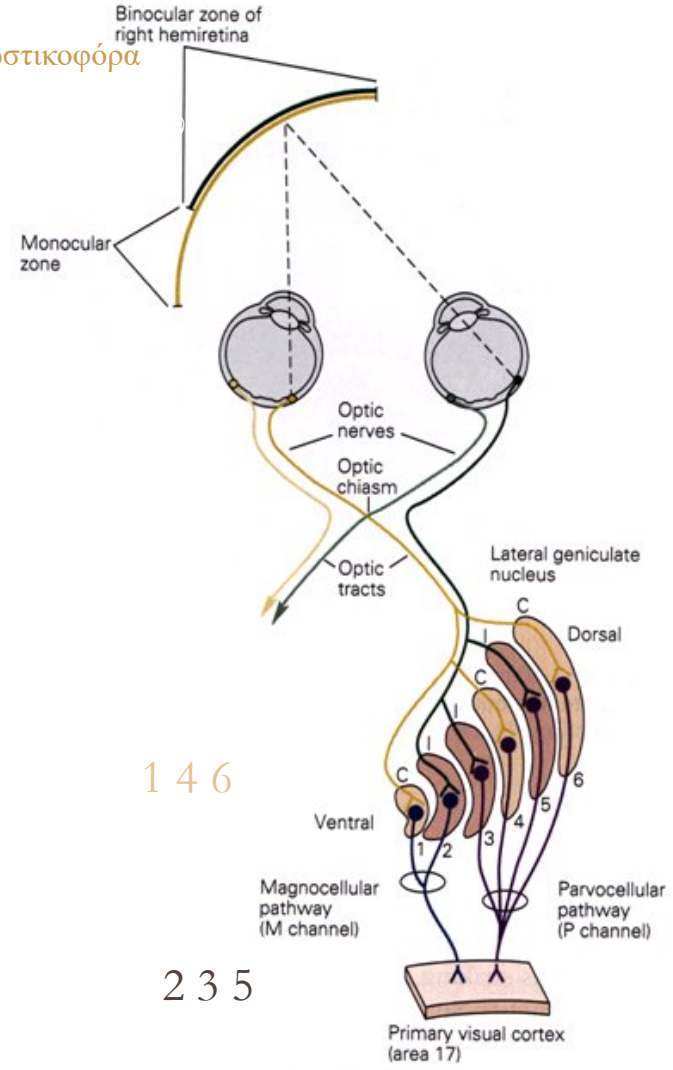
From N. Gluhbegovic and T.H. Williams. The human brain. Harper and Row. 1980


Πρόσθιον διδύμιον
Ὀπτικὴ ἀκτινοβολία


Rod Cell
Cone Cell
Fovea
Light
Retina
Optic Nerve

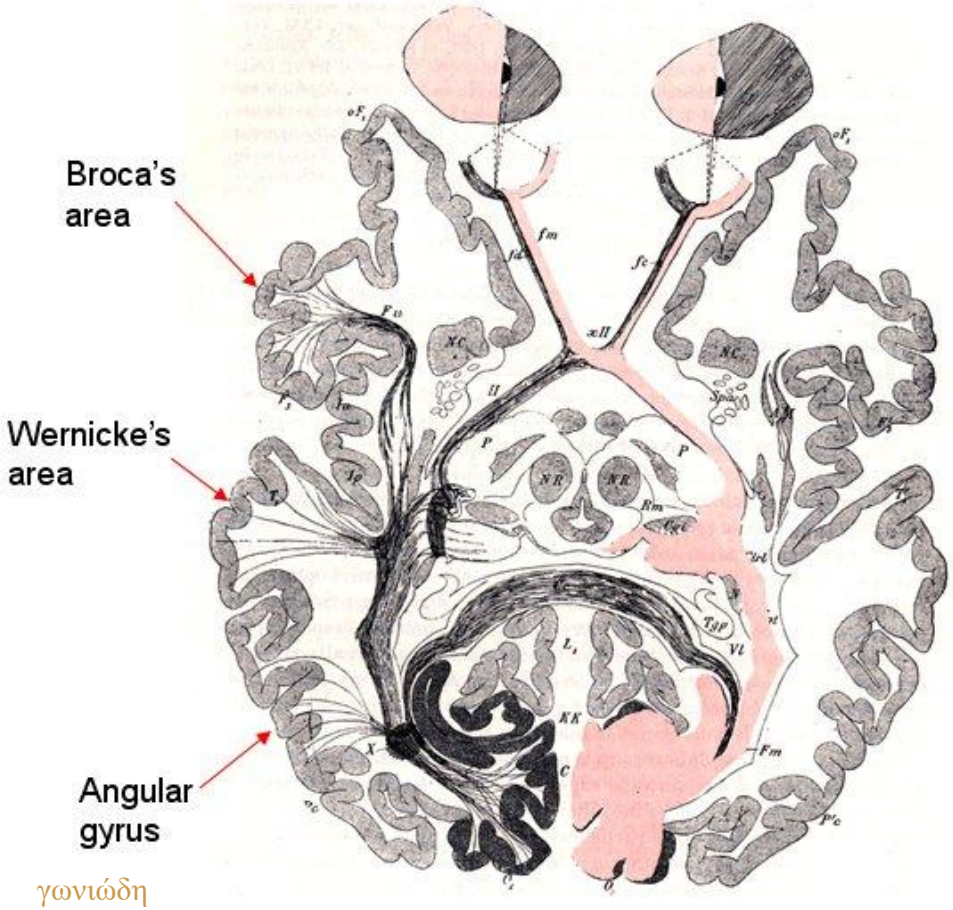
Visual pathways. Lateral geniculate body

The geniculate body has two types of layers: magnocellular (layers 1, 2) and parvo cellular (layers 3 to 6). All of the contralateral field of vision finds a projection on the same lateral geniculate body. Each temporal hemifield (nasal retina) of the contralateral side projects on layers 1,3 and 5 while the contra-lateral nasal hemifield (temporal retina) projects on layers 2, 3 and 6. It represents 90% of efferent visual information. The other 10% project on the superior colliculus (blindsight pathway). The efferent pathways and optic radiations end on the two banks of the striate cortex. Magnocellular cells are related to luminance and temporal frequency, while P cells to color and spatial frequency.



From R.H.Wurtz,E.Kandel .Central visual pathways in Principles of Neural sciences edited by E.Kandel,J.H.Schwartz, T.M. Jessell. McGraw Hill 2000

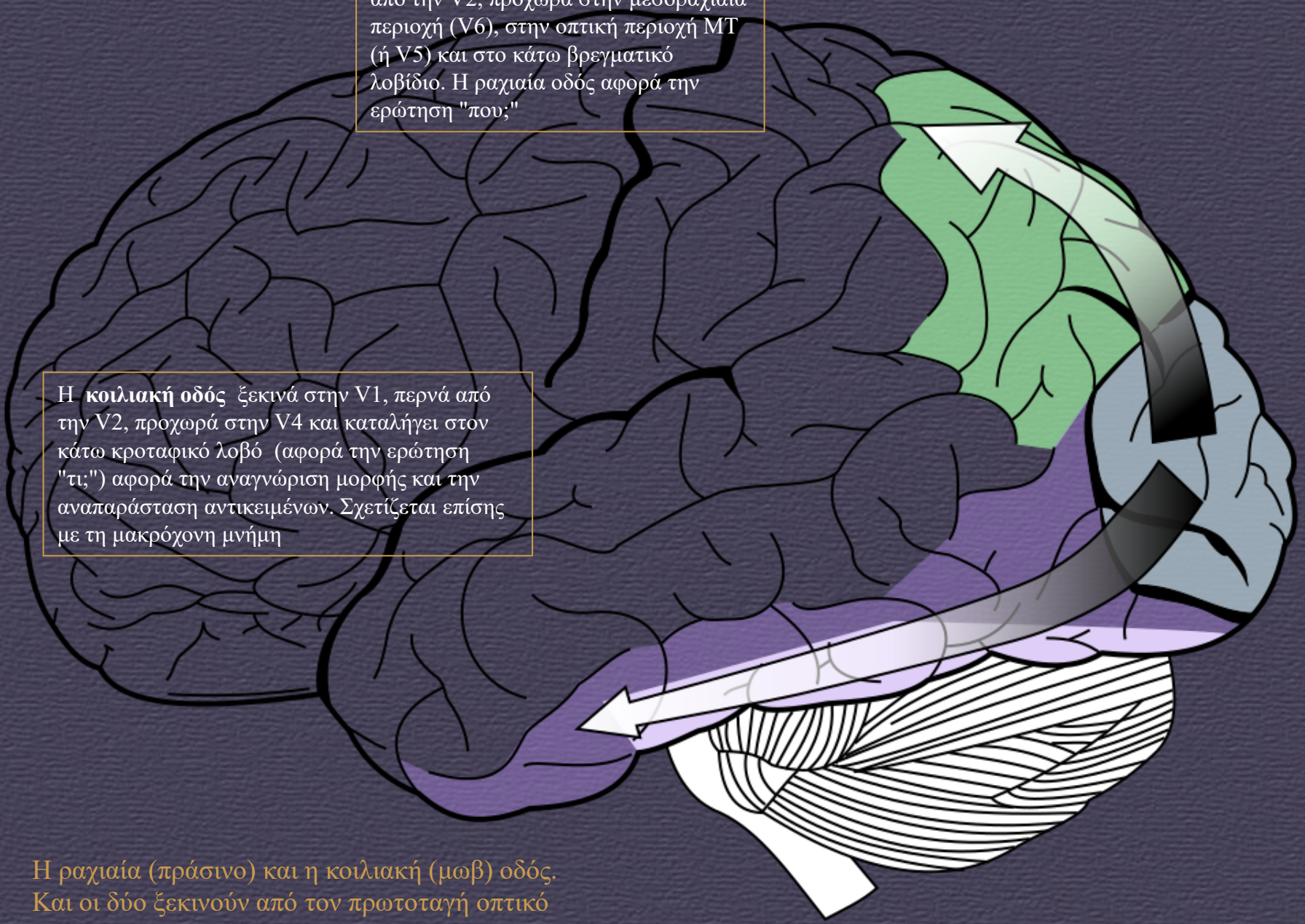
Visual pathways



Connections of visual pathways with angular gyrus and language areas in J.Dejerine . Anatomie des Centres nerveux. Rueff Paris 1895

Η ραχιαία οδός ξεκινά στην V1, περνά από την V2, προχωρά στην μεσοραχιαία περιοχή (V6), στην οπτική περιοχή MT (ή V5) και στο κάτω βρεγματικό λοβίδιο. Η ραχιαία οδός αφορά την ερώτηση "που;"

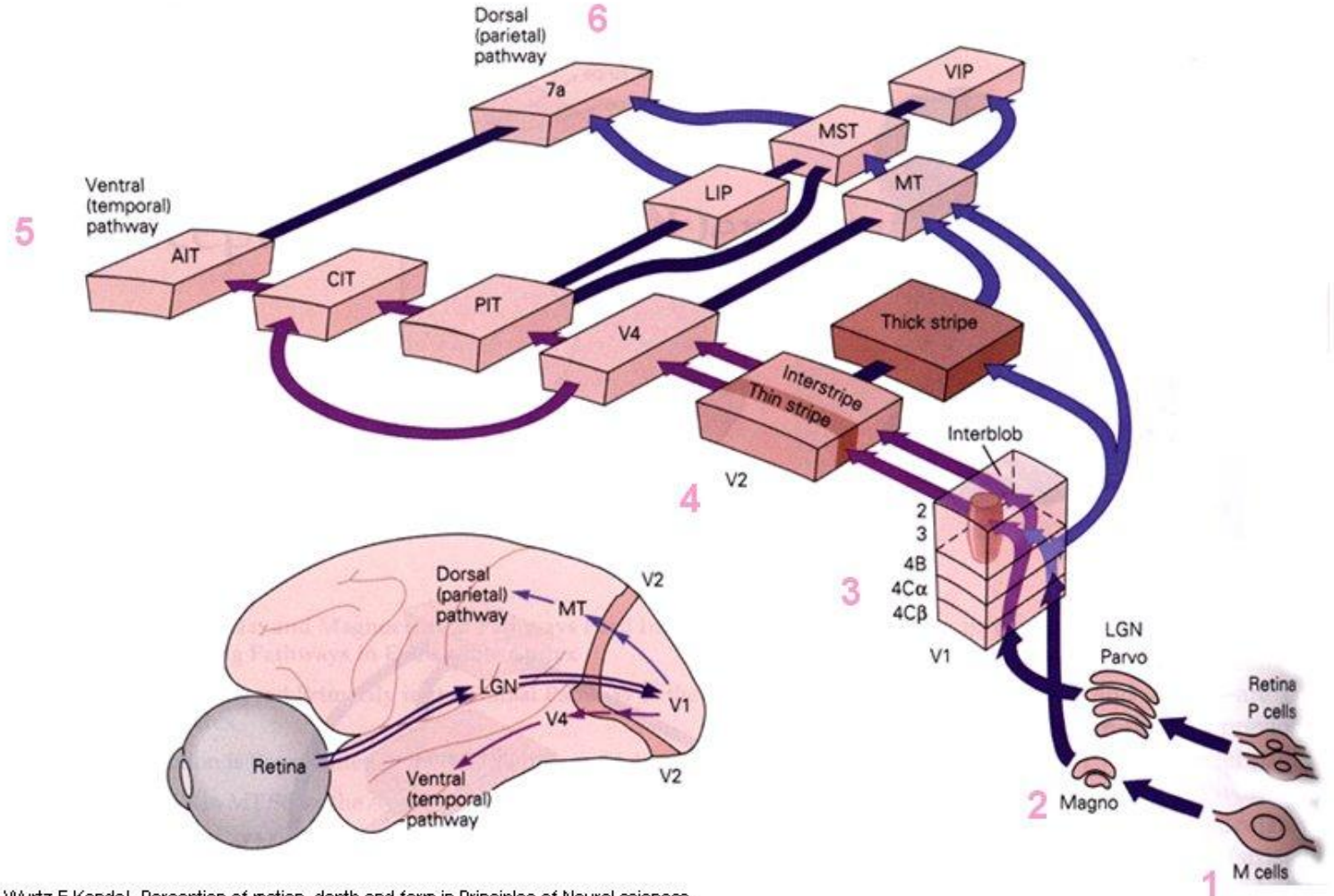
Η **κοιλιακή οδός** ξεκινά στην V1, περνά από την V2, προχωρά στην V4 και καταλήγει στον κάτω κροταφικό λοβό (αφορά την ερώτηση "τι;") αφορά την αναγνώριση μορφής και την αναπαράσταση αντικειμένων. Σχετίζεται επίσης με τη μακρόχονη μνήμη



Η ραχιαία (πράσινο) και η κοιλιακή (μωβ) οδός. Και οι δύο ξεκινούν από τον πρωτοταγή οπτικό φλοιό.

Visual pathways: Ventral and dorsal

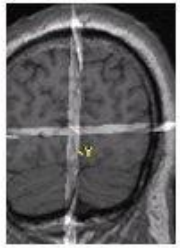
Projections from retina (1) to magno and parvo cellular layers of the lateral geniculate body (2). From LGB, visual inputs project to the primary visual cortex (3). The projections from V1 to V2 (4) will give rise to two different pathways: the ventral (5) and the dorsal (6).

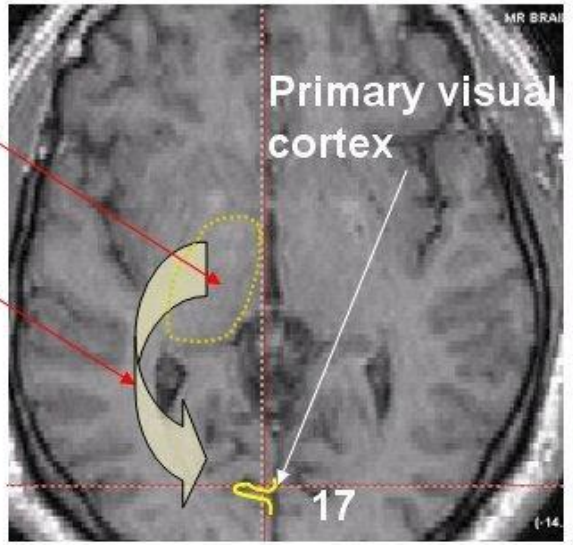


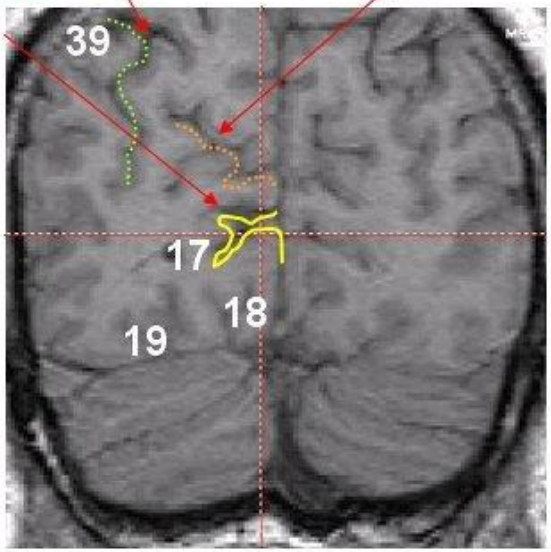
From R.H.Wurtz,E.Kandel .Perception of motion, depth and form in Principles of Neural sciences edited by E.Kandel,J.H.Schwartz, T.M. Jessell. McGraw Hill 2000

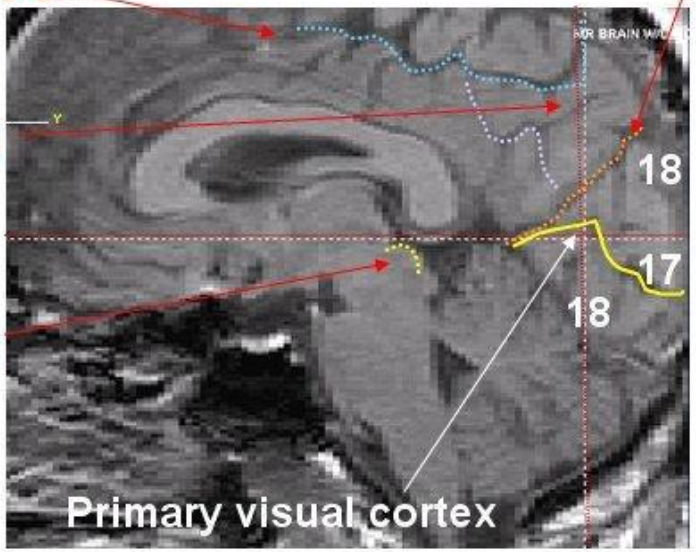
Occipital lobe

Projection of the anterior part of calcarine fissure (right side).



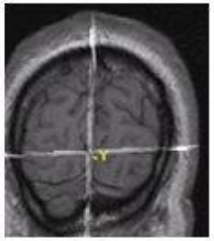


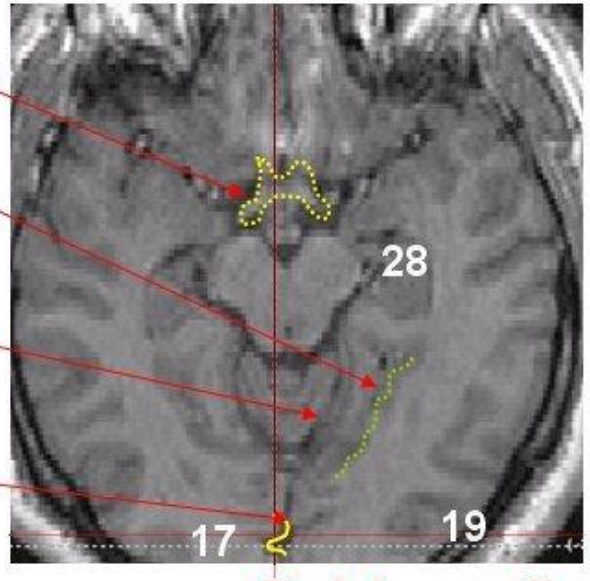


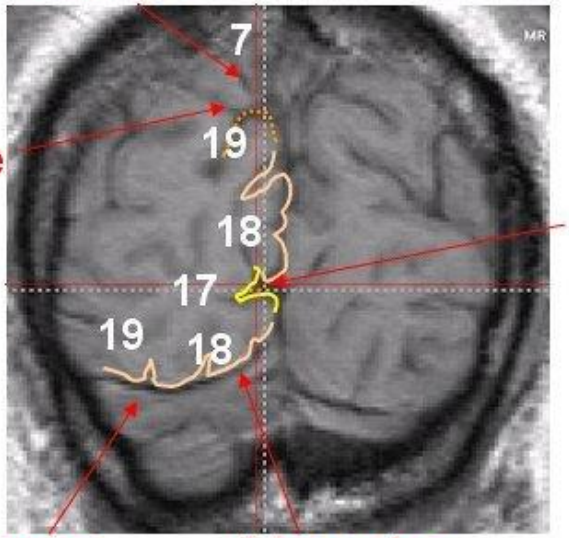


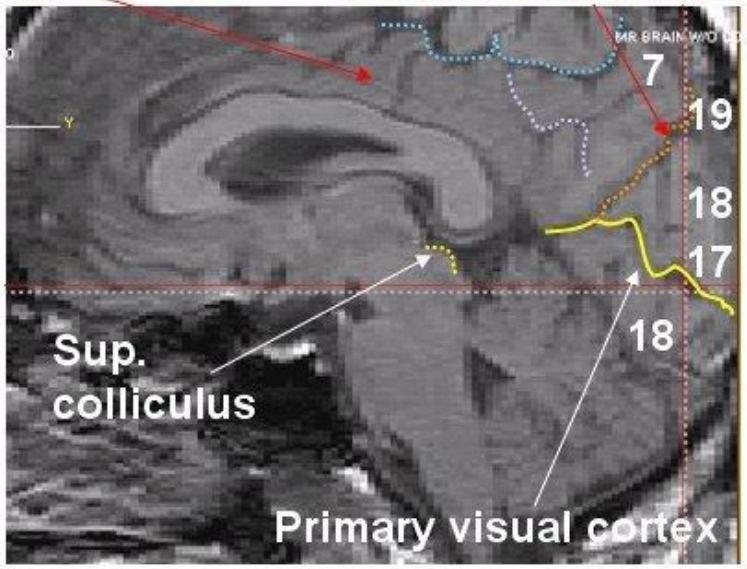
Occipital lobe

Projection of the posterior part of the calcarine fissure (right side).



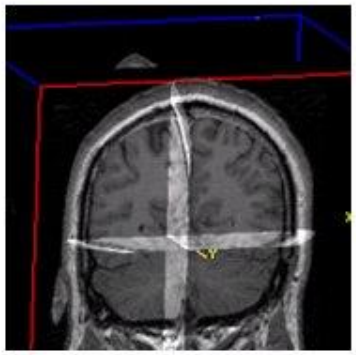


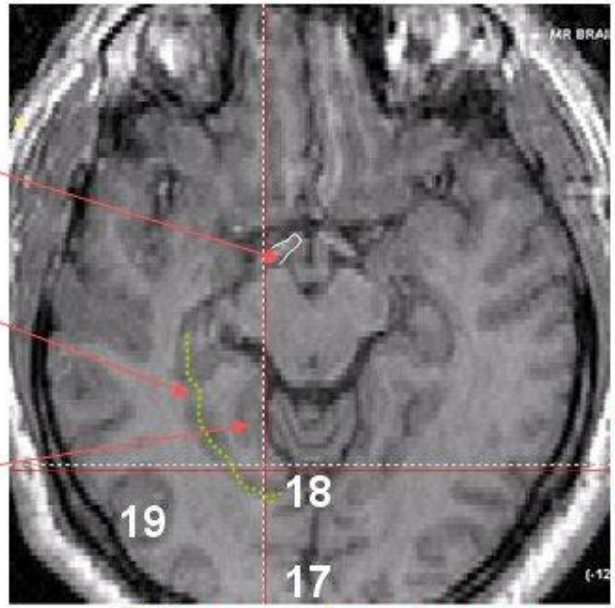


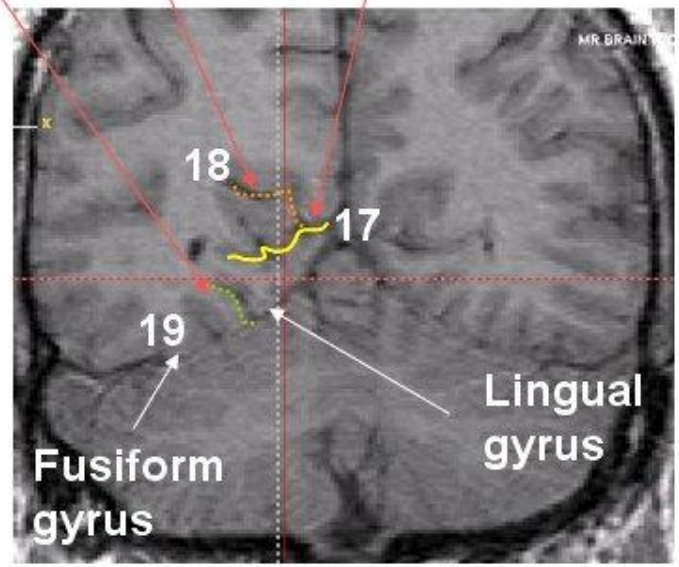


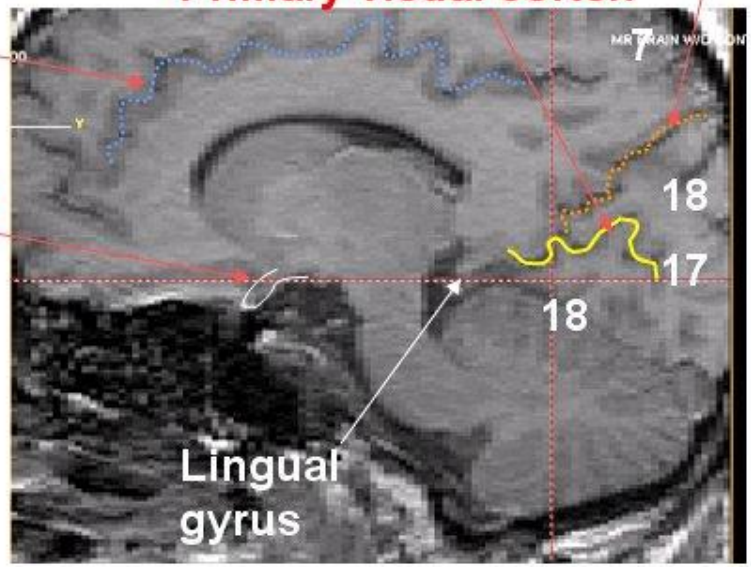
Occipital lobe

Projection of the lingual gyrus (right side).



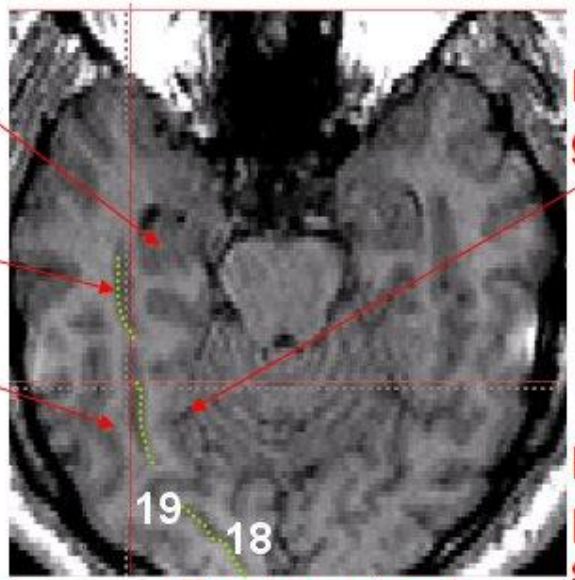


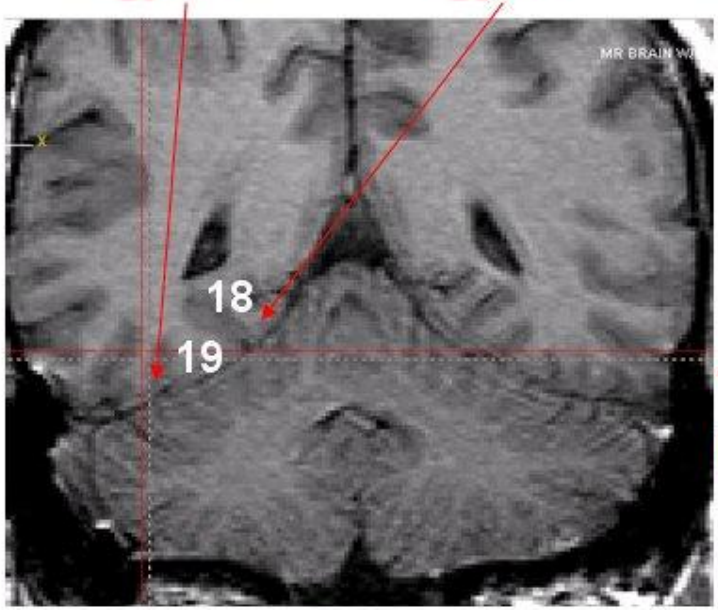


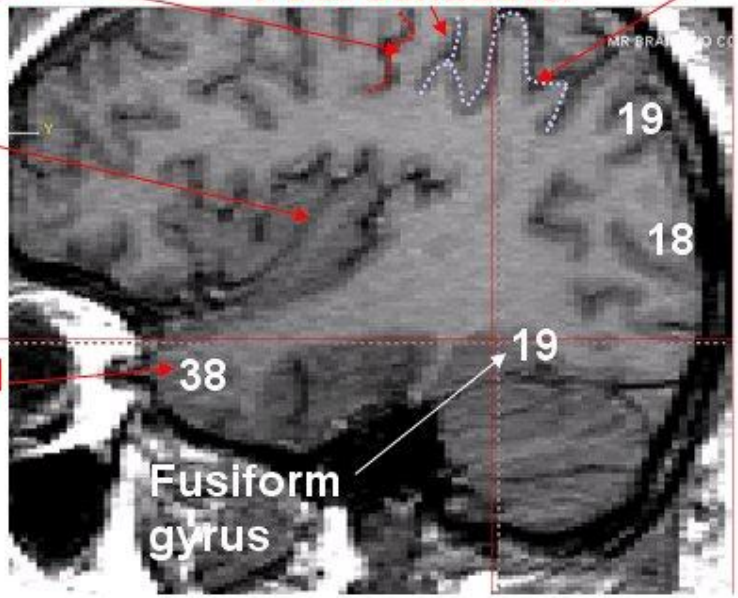


Occipital lobe

Projection of the fusiform gyrus.

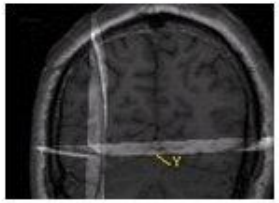


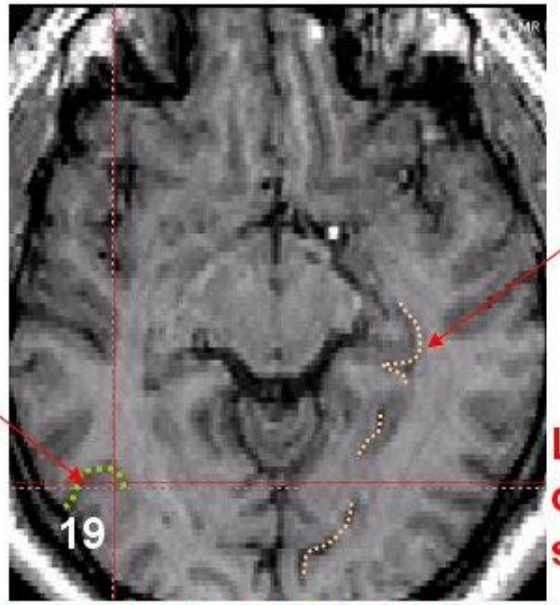


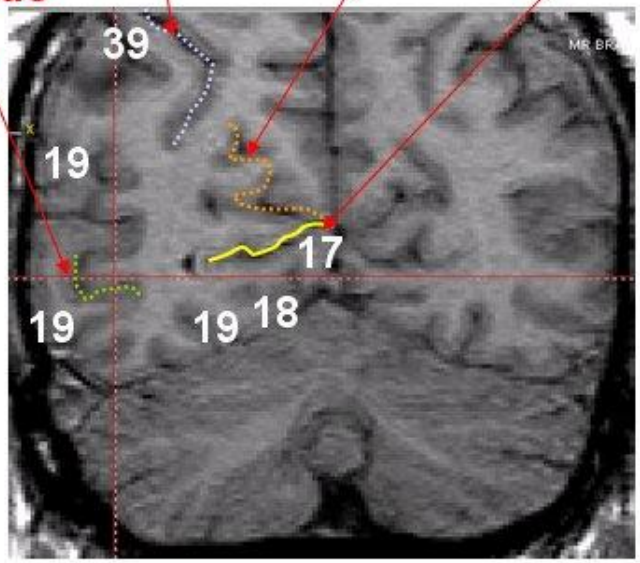


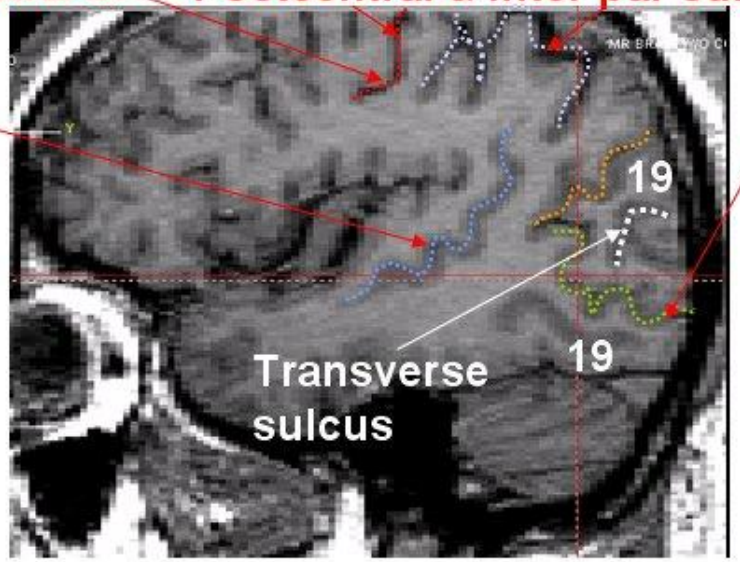
Occipital lobe

External part of the occipital lobe.



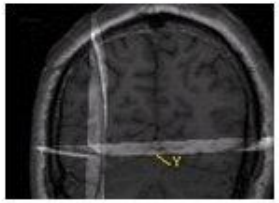


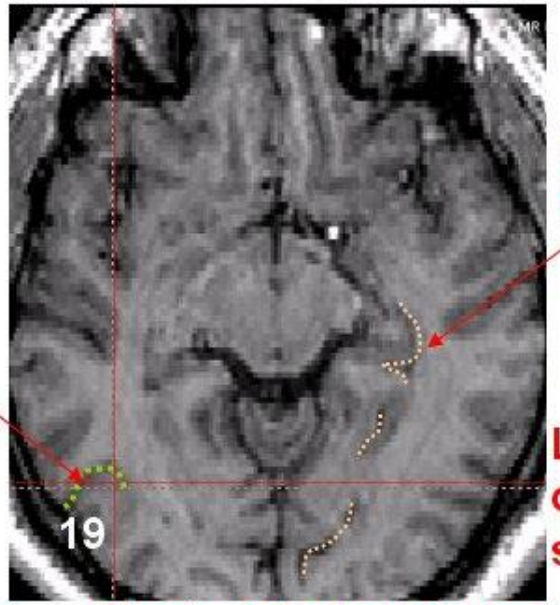


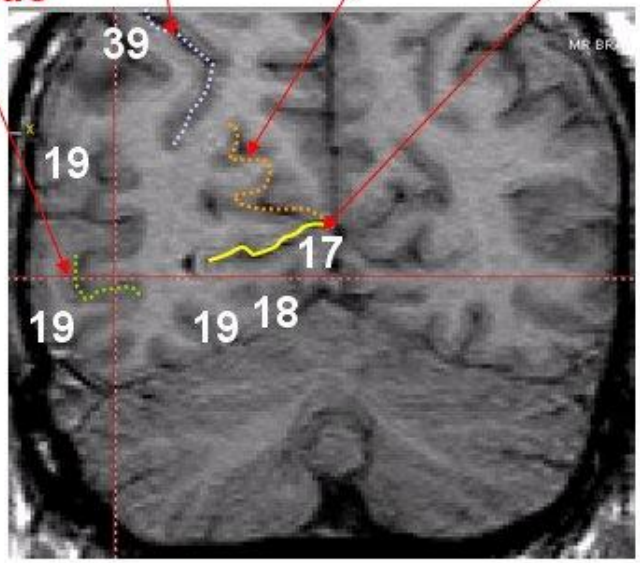


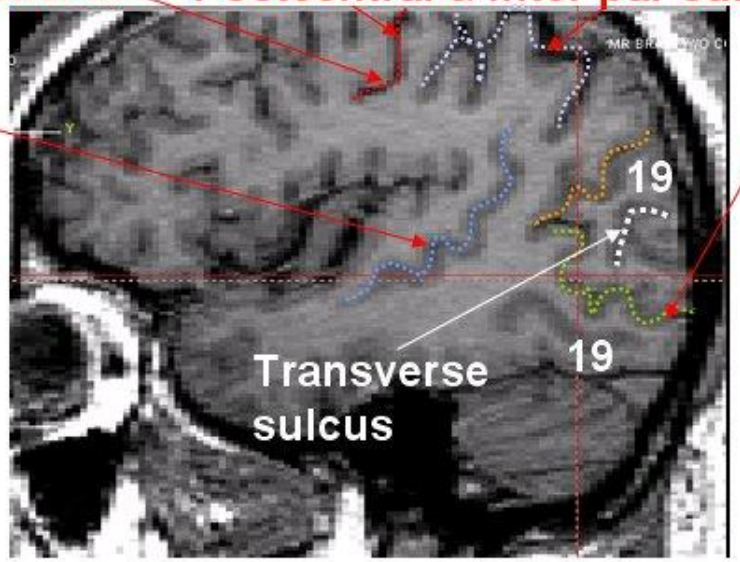
Occipital lobe

External part of the occipital lobe.

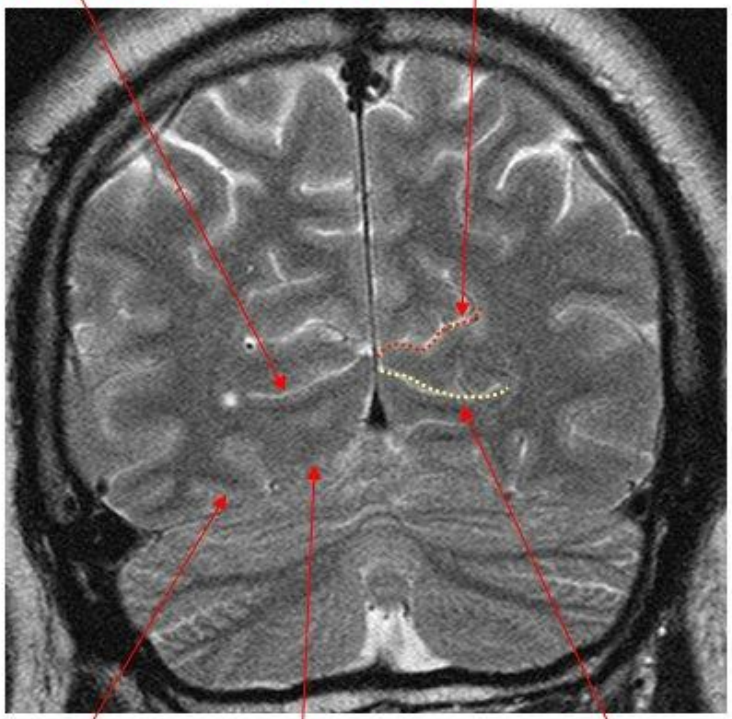


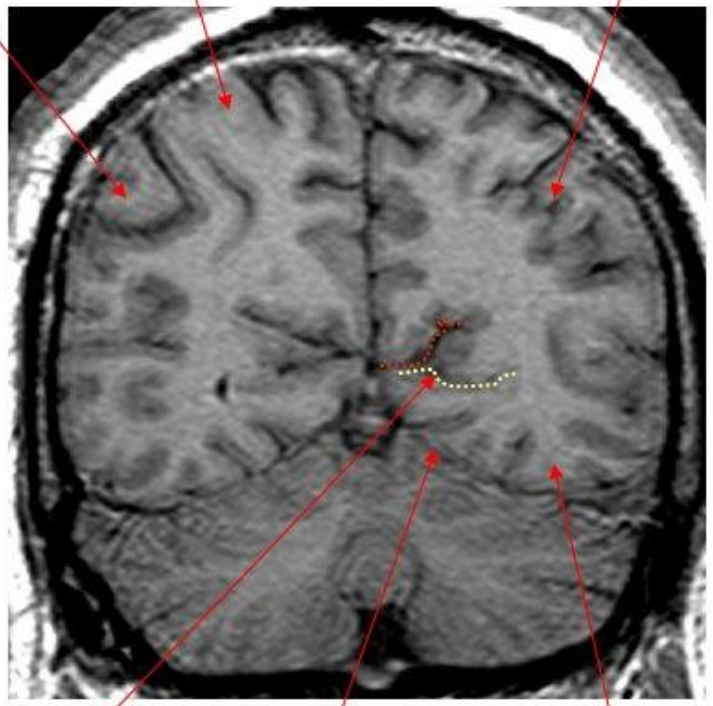




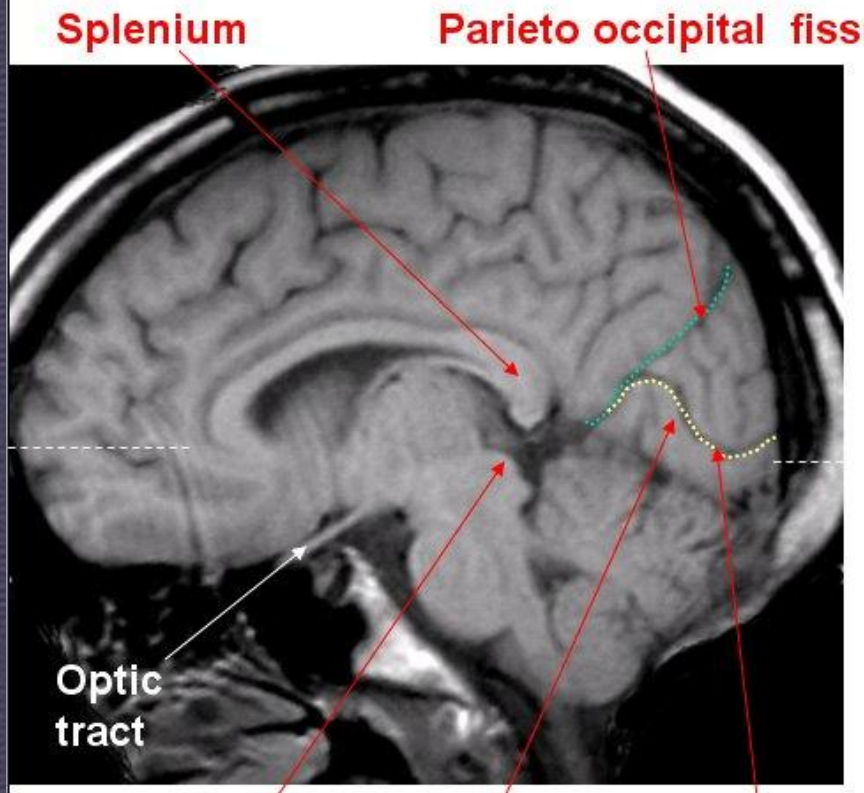


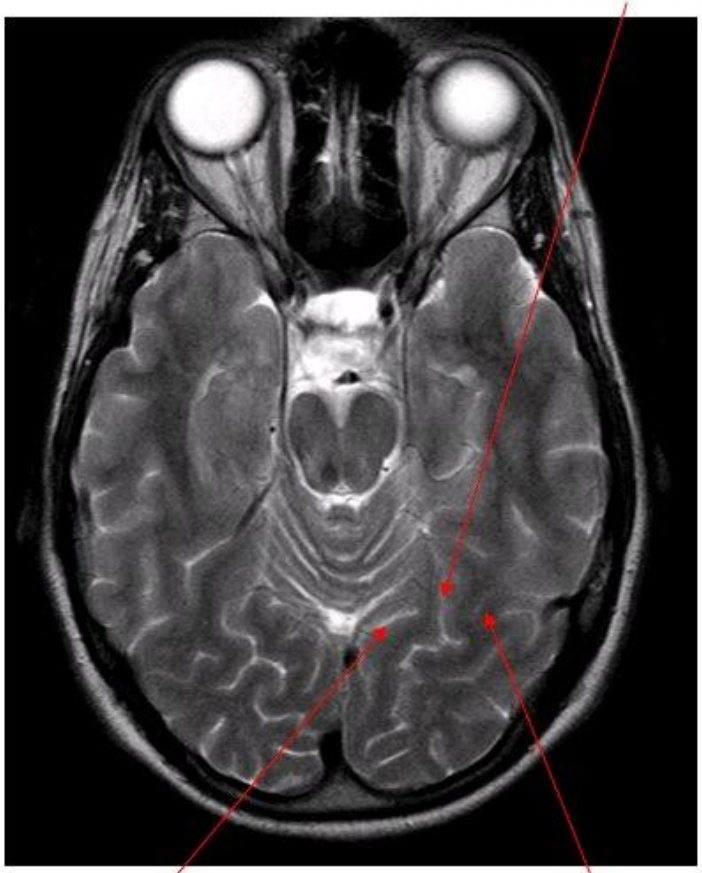
MRI of occipital lobe

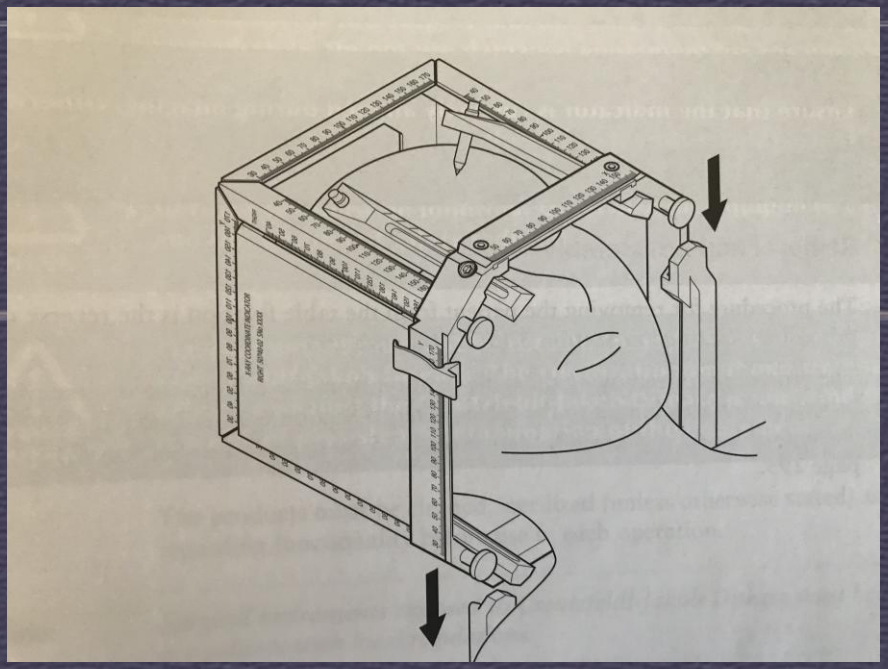


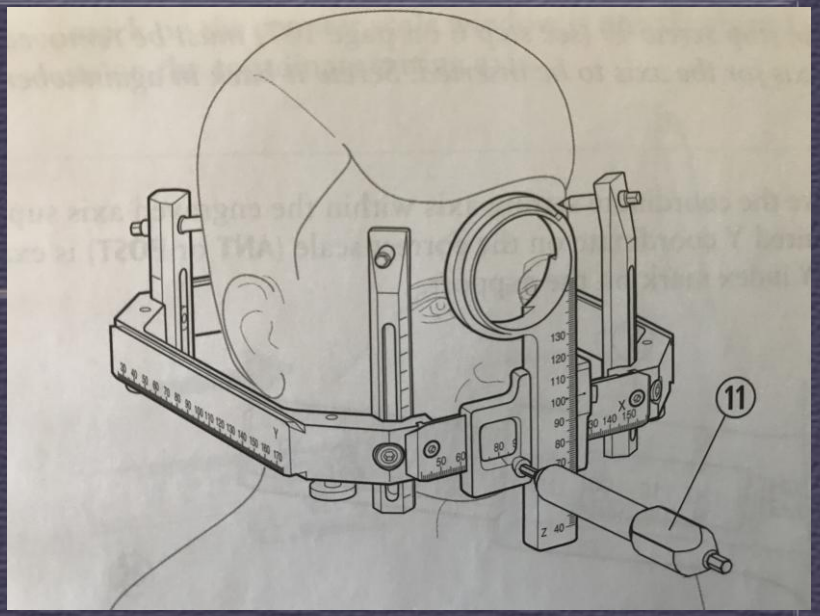


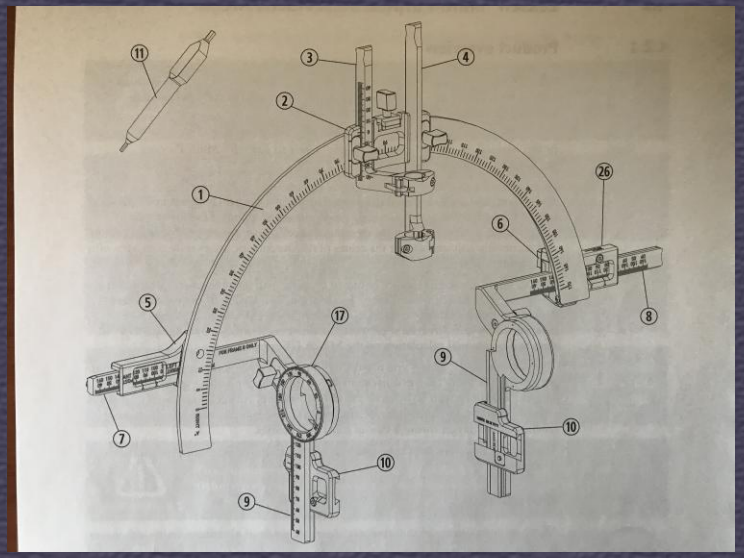
MRI of occipital lobe

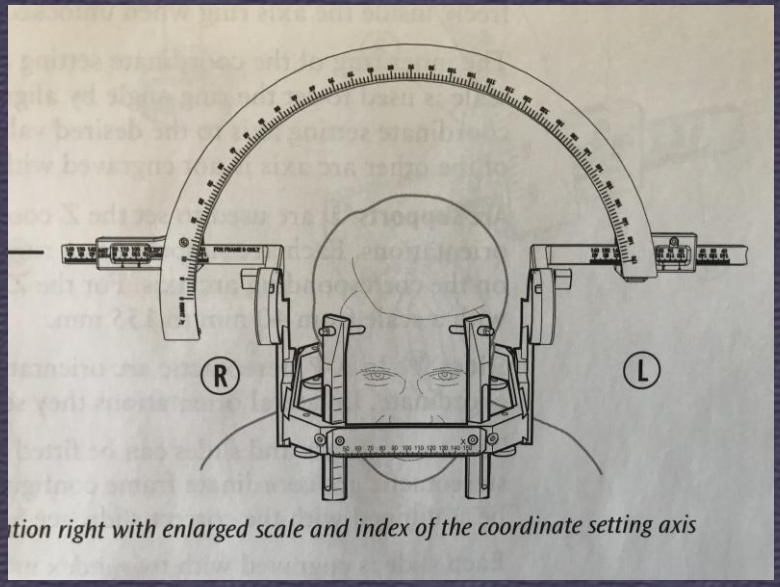






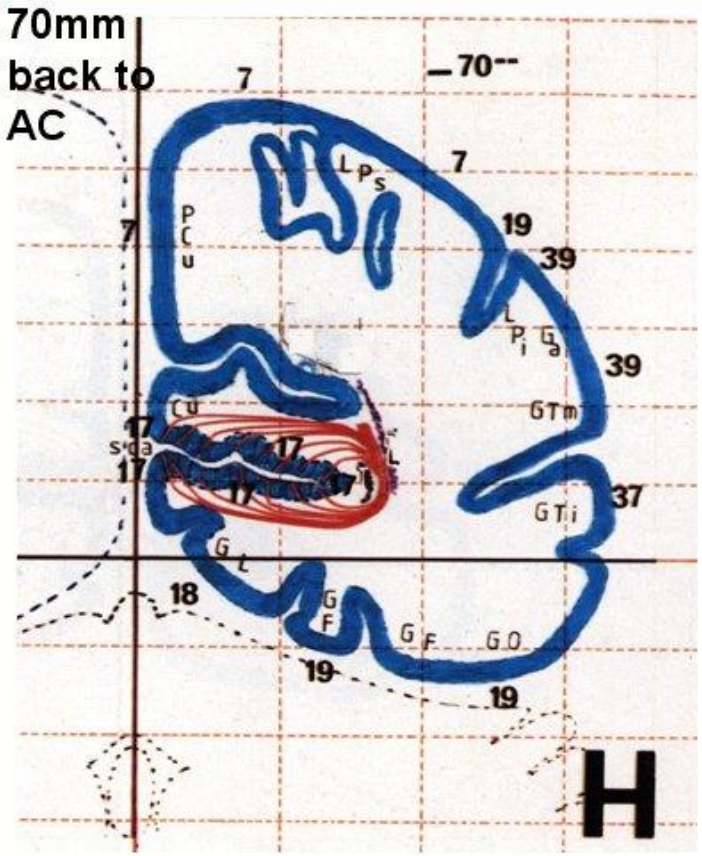


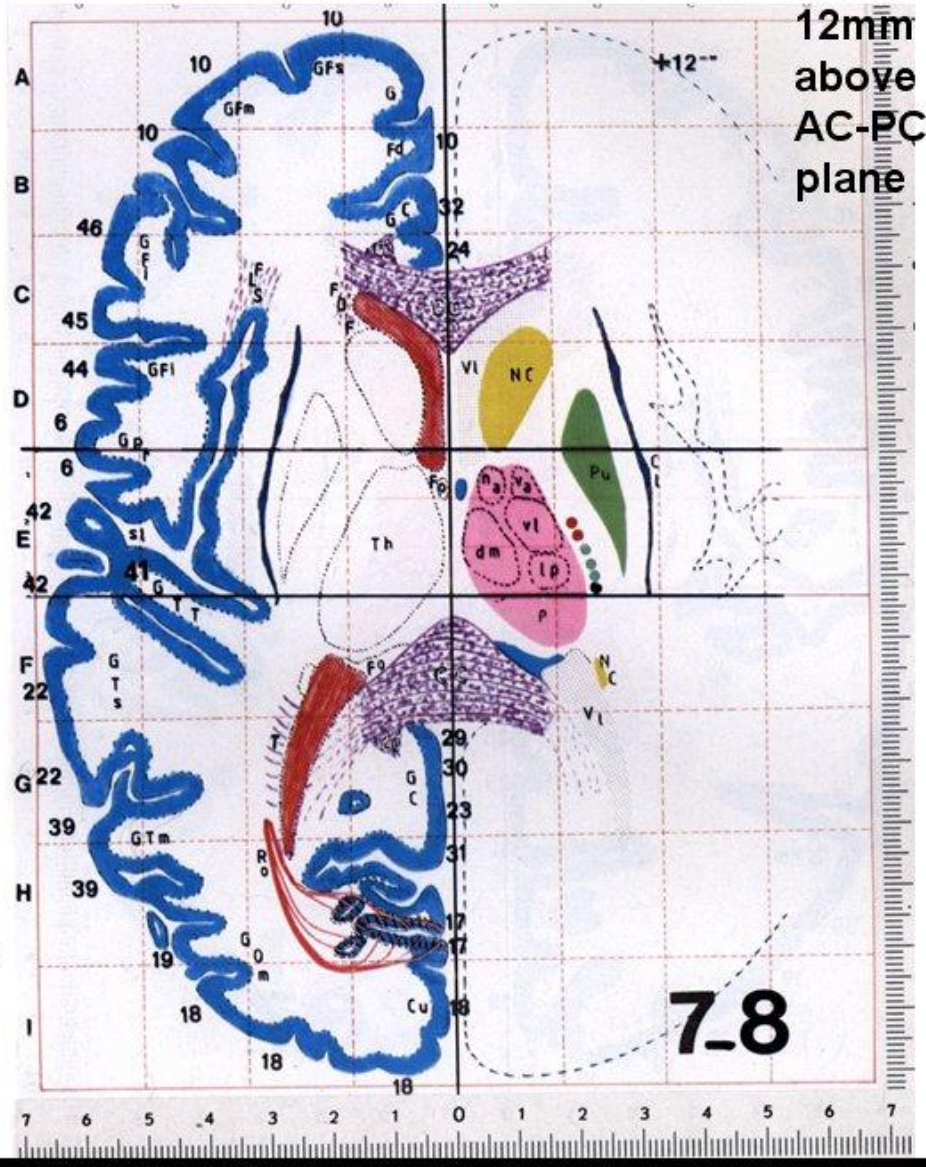




tion right with enlarged scale and index of the coordinate setting axis

Occipital lobe: Stereotaxic coordinates



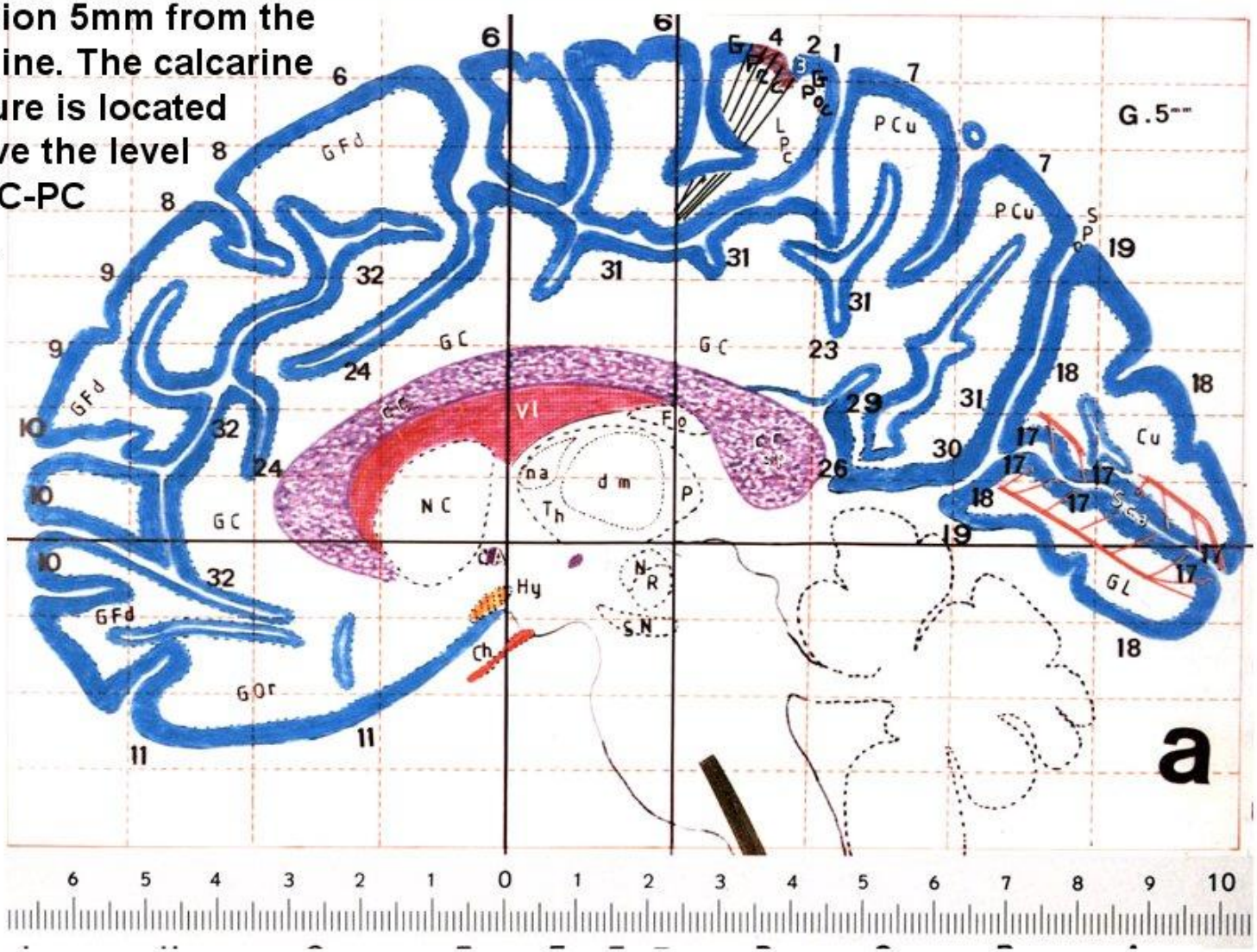


Projection of primary visual cortex on coronal and horizontal sections perpendicular and parallel to the commissural plane.

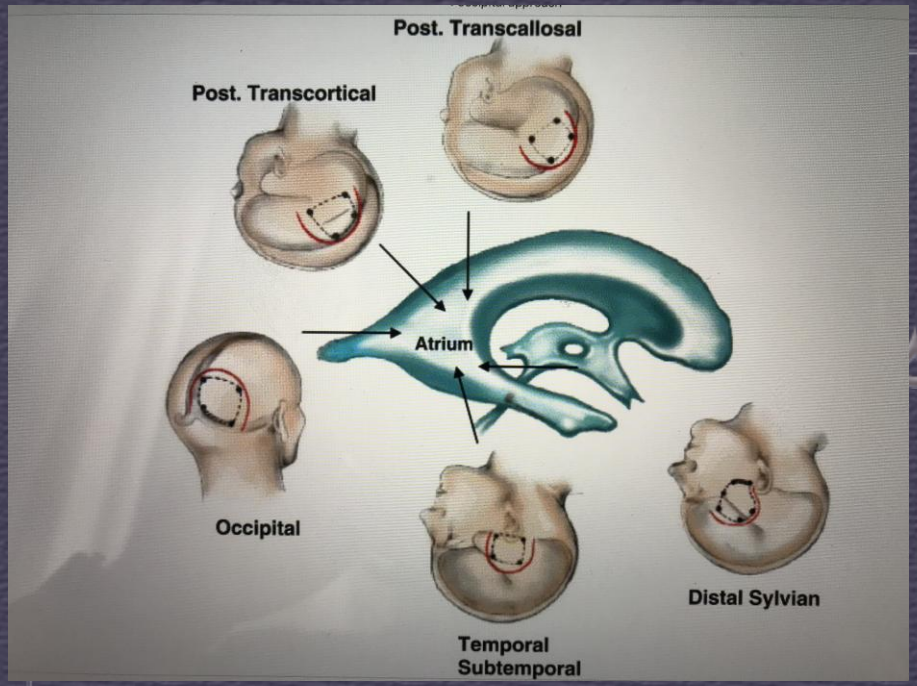
From J.Talairach, P.Tournoux Coplanar stereotaxic atlas of the human brain. Thieme. 1988

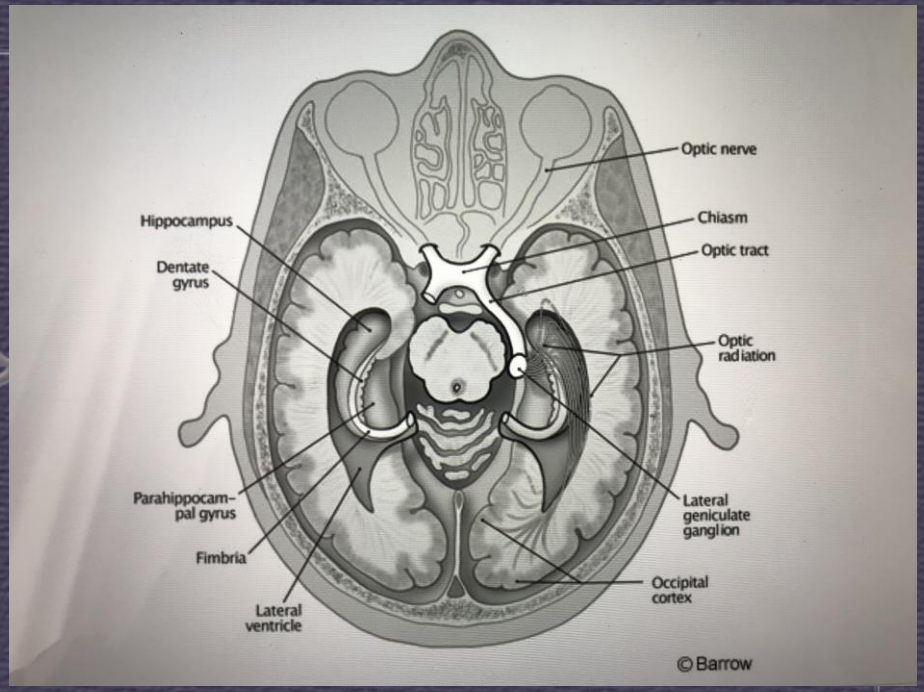
Occipital lobe: Stereotaxic coordinates

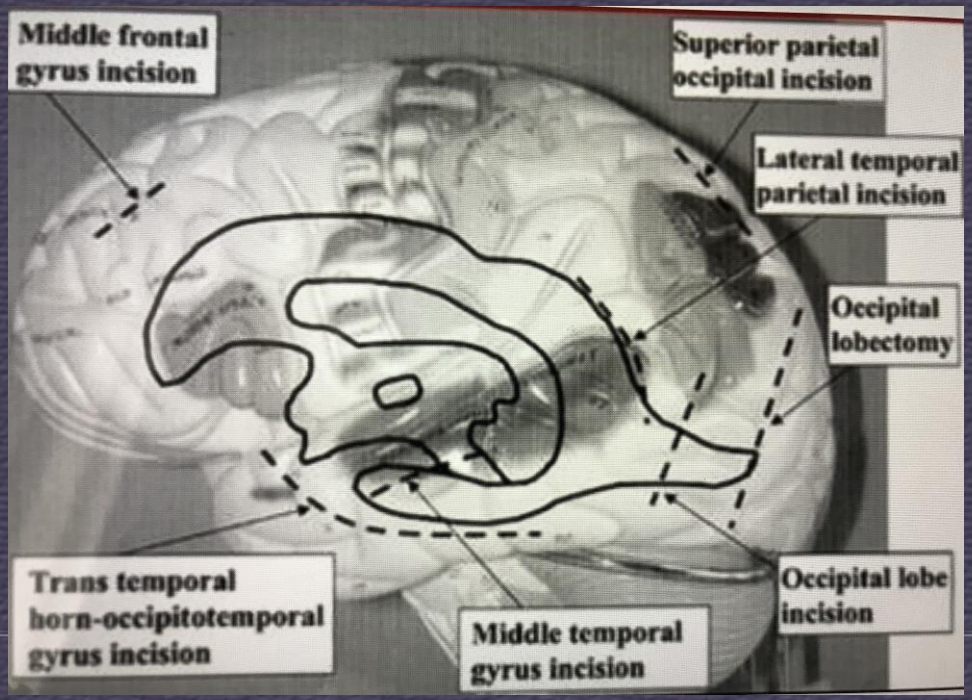
Section 5mm from the midline. The calcarine fissure is located above the level of AC-PC line.



From J.Talairach, P.Tournoux Coplanar stereotaxic atlas of the human brain. Thieme. 1988

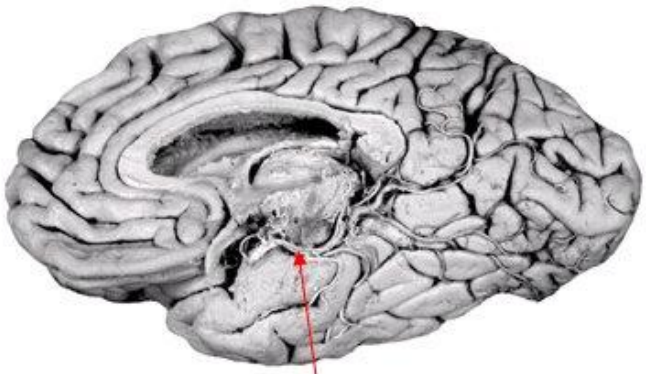

Post. Transcallosal
Post. Transcortical
Atrium
Occipital
Distal Sylvian
Temporal
Subtemporal


Optic nerve
Chiasm
Optic tract
Hippocampus
Dentate gyrus
Optic radiation
Parahippocampal gyrus
Lateral geniculate ganglion
Fimbria
Occipital cortex
Lateral ventricle
© Barrow

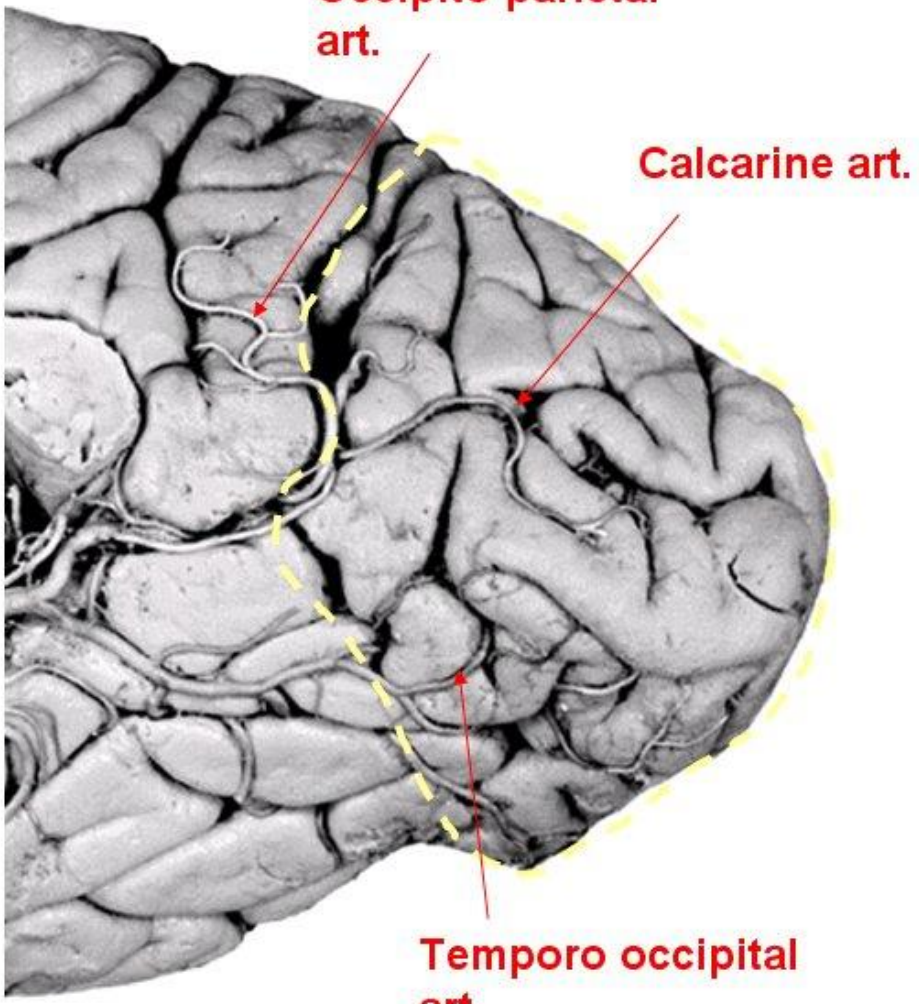

Middle frontal gyrus incision
Superior parietal occipital incision
Lateral temporal parietal incision
Occipital lobectomy
Trans temporal horn-occipitotemporal gyrus incision
Middle temporal gyrus incision
Occipital lobe incision

Occipital lobe and visual pathways

Vascularization
from PCA

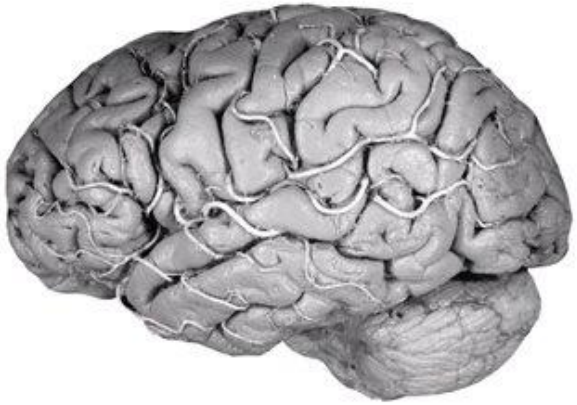


Posterior
cerebral artery

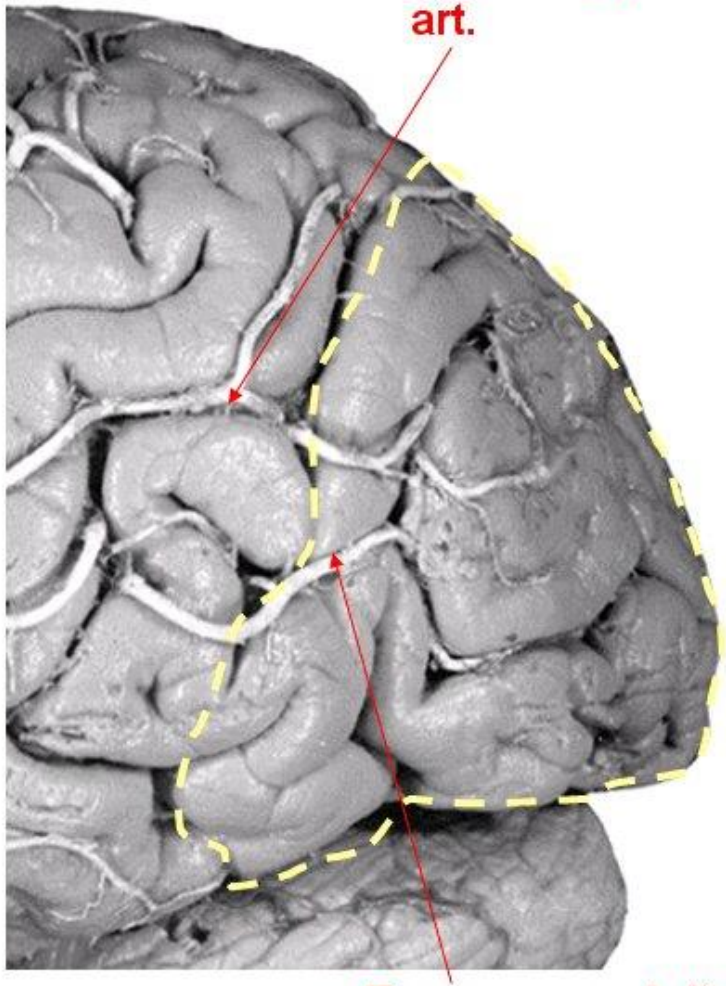


Occipital lobe and visual pathways

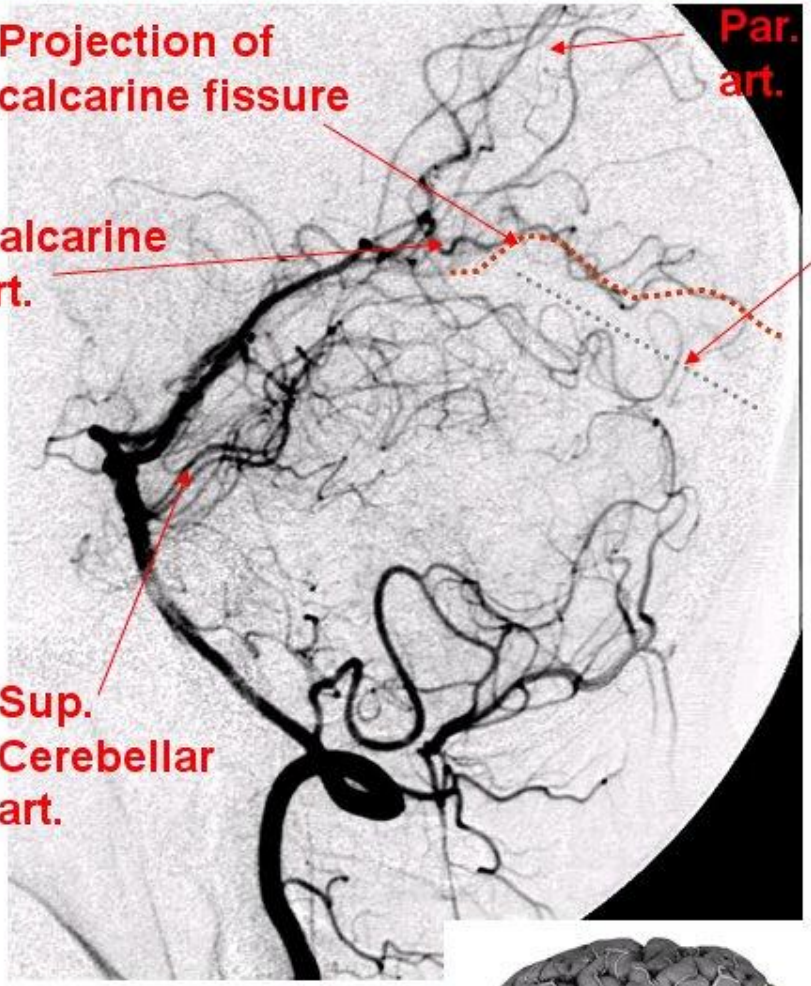
Vascularization from MCA



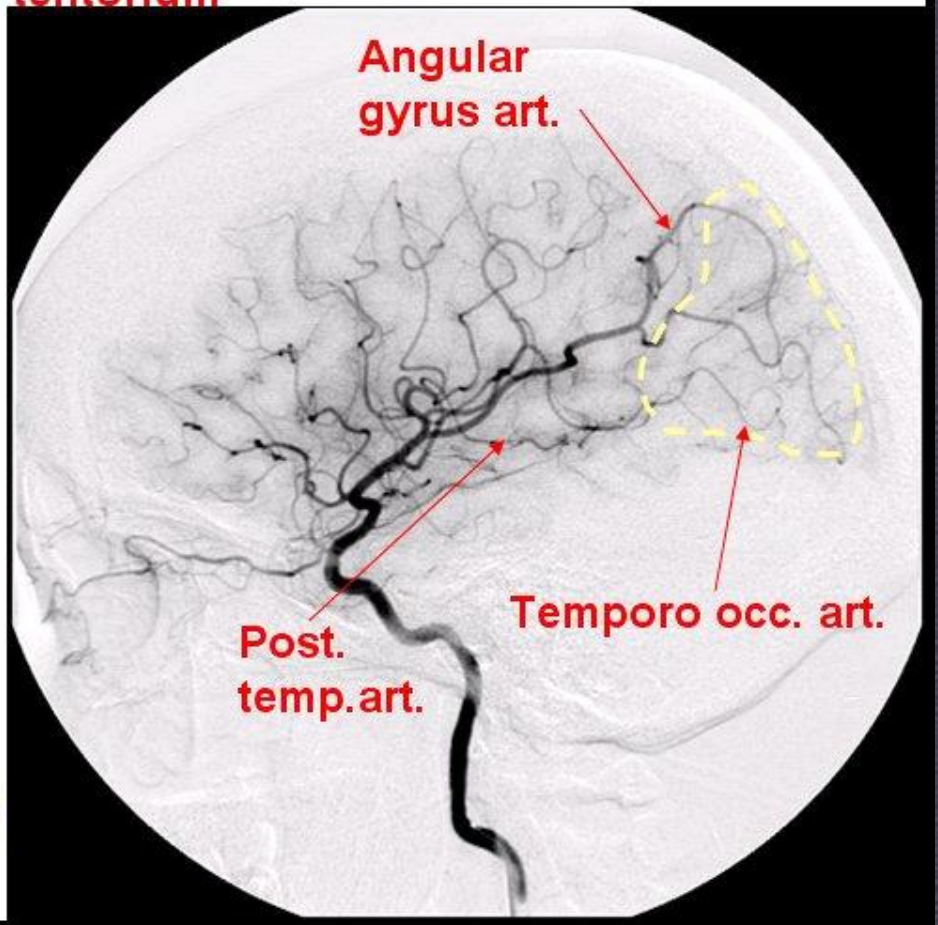
Cortical branches of the middle cerebral artery



MRI of occipital lobe and Angiography

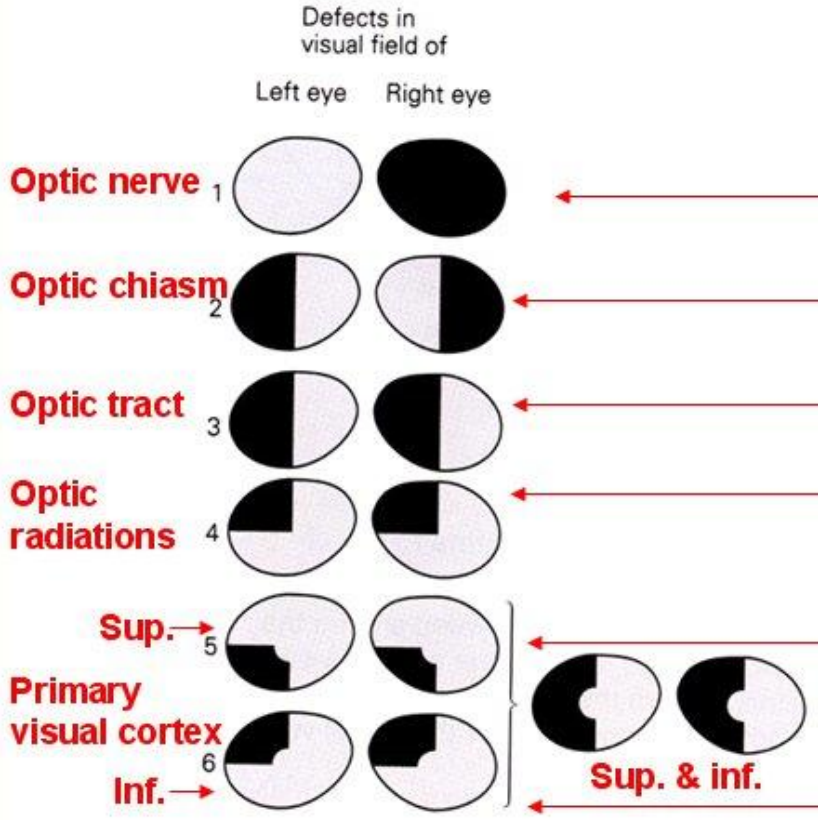


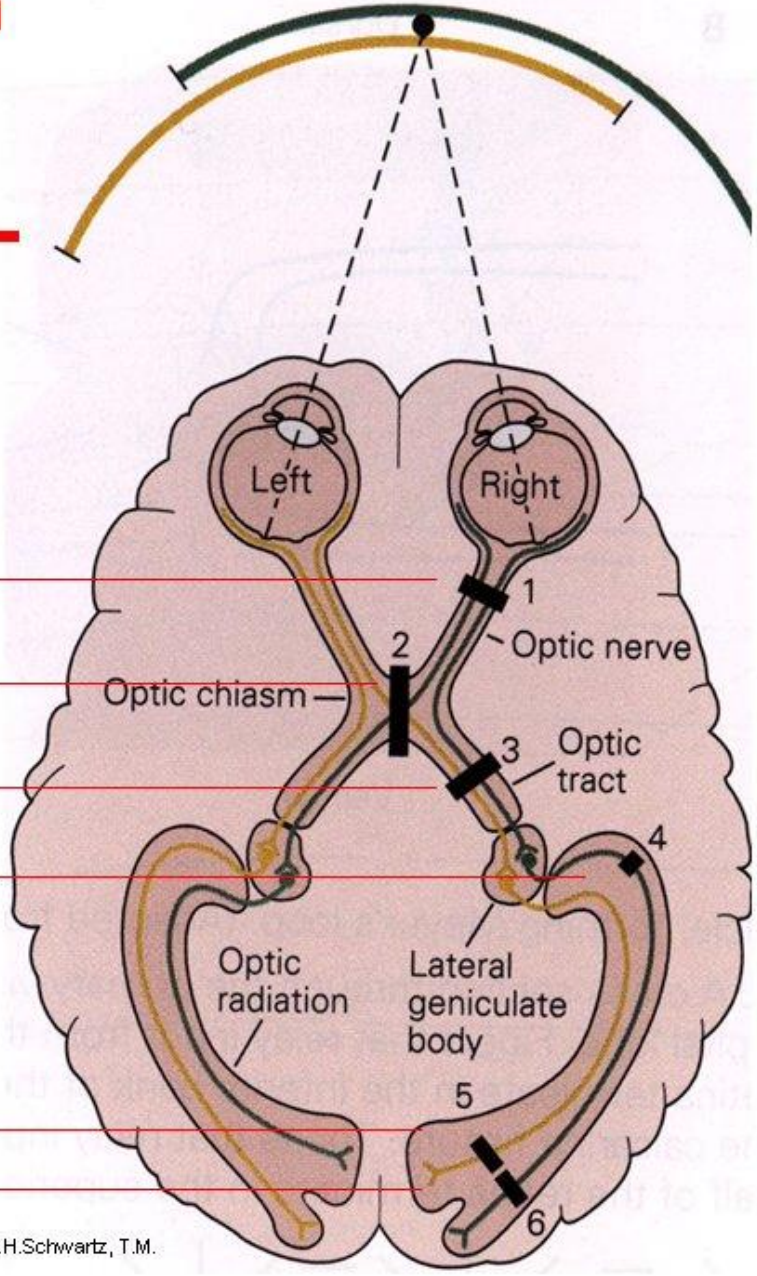
Carotid angiography. Lateral view. In this case, only the branches of the MCA are visible.



Vertebro basilar angiography. Lateral view.

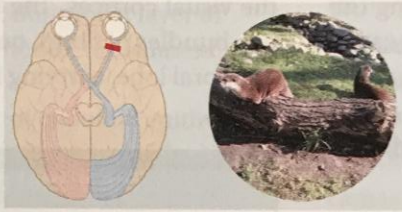
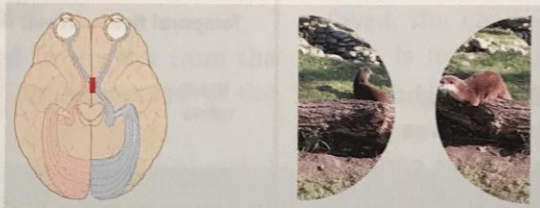
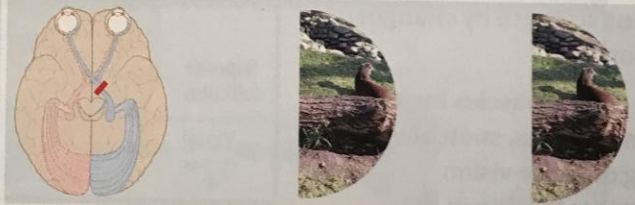
Visual field defects in relation with the site of a lesion on the optic pathways





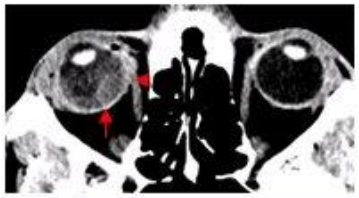
From R.H.Wurtz,E.Kandel .Central visual pathways in Principles of Neural sciences edited by E.Kandel, J.H.Schwartz, T.M. Jessell. McGraw Hill 2000

Visual pathway lesions and visual field defects

Lesion location	Lesion location and visual field defect
None	
Optic nerve	
Optic chiasm	
Optic tract	
Optic radiation (temporal pathways)	
Optic radiation (calcarine)	

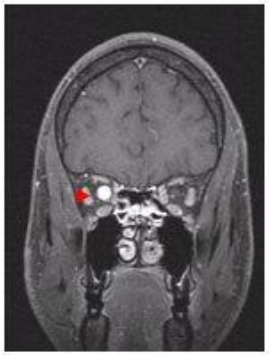
Visual pathways: Different topographic lesions

1. Retina



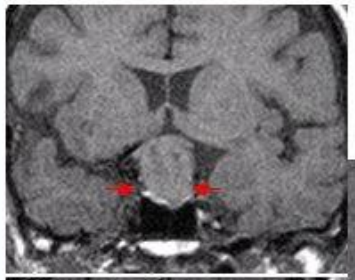
Retinal detachment on right side

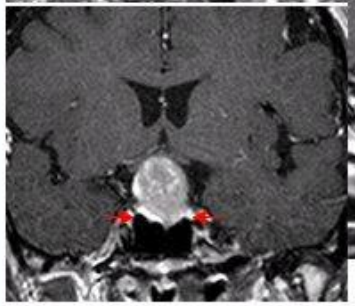
2. Optic nerve

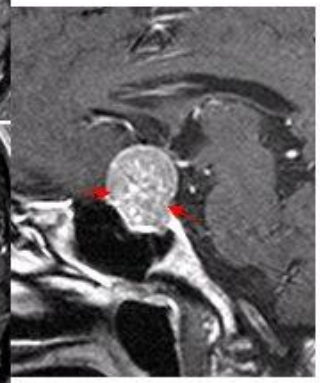


Optic nerve glioma

3. Chiasma

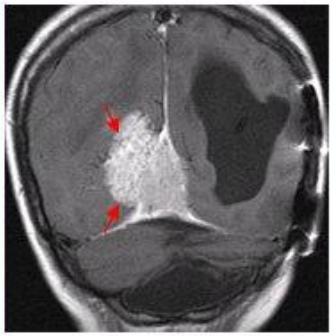


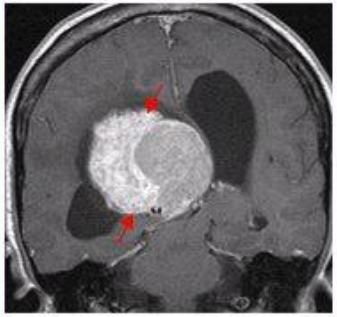




Hypophyseal adenoma with chiasmatic compression

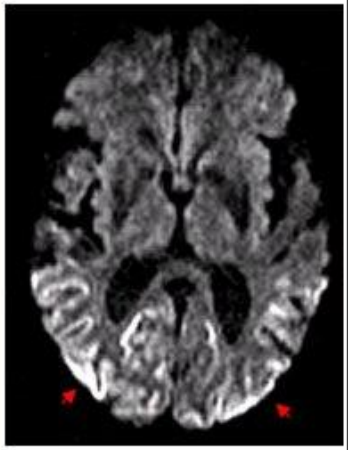
4. Visual pathways





Compression of visual pathways by falco tentorial meningioma

5. Visual cortex



Creutzfeld Jakob's disease with occipital abnormalities

Higher visual functions in clinical neurology

Striate and Peristriate Syndromes

The most common sign in lesions involving the primary visual area is a homonymous scotoma of the contralateral field. In cases of bilateral infarcts, a denial of blindness may be observed: Anton's syndrome.

Akinetopsia is the loss of ability to detect visual motions. It is observed mainly in bilateral lesions.

Central achromatopsia is an acquired loss of color perception. It is observed in lesions of the ventro medial aspect of the occipital lobe.

Ventral Occipital Fugal Syndromes

They correspond to lesions in the field of ventral pathways- the pathway called "what?" by opposition to the dorsal one "where?".

There are three main ventral occipital syndromes in relation to verbal, visual or memory abilities. The visuo verbal syndrome concerns mainly color. A color anomia is observed in left occipital lesions in association with a right homonymous hemianopia. Difficulty or inability to read, or word blindness, is observed in left occipito temporal lesions at the level of the fusiform and lingual gyrus. Difficulty to name objects, "optic aphasia", corresponds to left occipito temporal infarcts with right homonymous hemianopia. When this syndrome occurs, there is often an alexia and a color anomia. The difficulty to recognize faces, even one's own, is called prosopagnosia. It is observed as a rare syndrome in bilateral occipito temporal infarcts.

Higher visual functions in clinical neurology

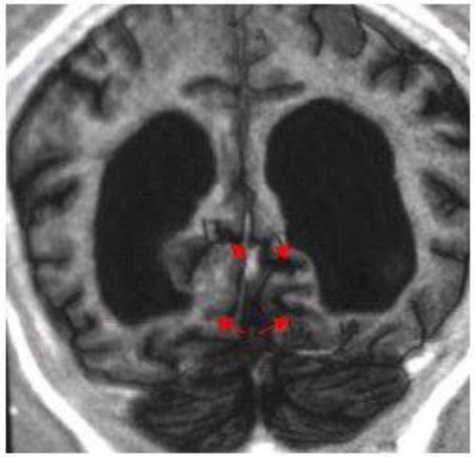
The dorsal pathway syndromes are observed in occipito parietal areas lesions, very often bilateral. The most common one is Balint's syndrome with optic ataxia, apraxia and simultanagnosia (difficulty to realize the synthesis of a complex scene). Hemi spatial neglect corresponds mainly to right parieto occipital lesions. The patient has lost the knowledge of his left visual field's area.

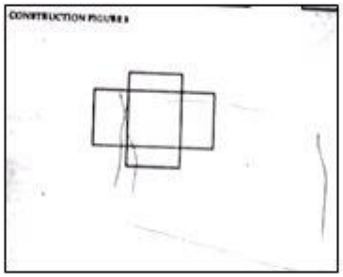
from M.Mesulam. Higher visual functions of the cerebral cortex and their disruption in clinical practice chapt. 209 in Albert, Jakobiec Principles and Practice of Ophtalmology. Saunders. 1994

The visual syndromes observed along the visual pathways are different and mainly in relation with the site of the lesion. Any lesion at the optic nerve level may give rise to an impairment of vision in the corresponding eye.

Primary optic atrophy with a paleness of papilla is in relation with optic nerve disease. This occurs not only in a case of tumor but also in MS with plaques at the optic nerve level. The Foster Kennedy syndrome consists of an optic atrophy on one side, a site of compression of the optic nerve by a tumor, and a papilledema on the other side in relation with intra cranial pressure. When the compression arises from the pituitary, the chiasm is compressed on the midline, with damage to crossing fibers. It will lead to a bitemporal hemianopia, which begins in general in upper bitemporal quadrants. Very rarely a binasal hemianopia could correspond to a bilateral compression of the chiasm on its lateral aspect. All lesions involving optic tract, lateral geniculate body and optic radiations are followed by an homonymous lateral hemianopia.

Occipital lobe. Degenerative diseases



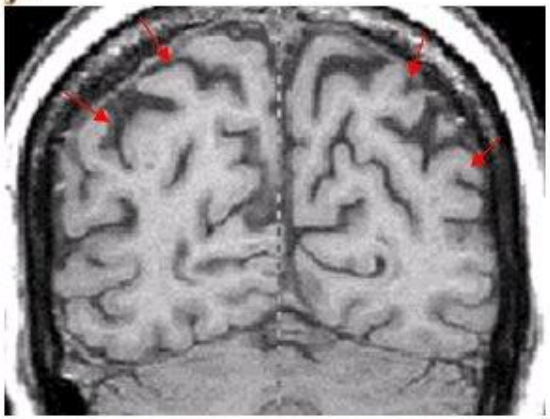


Primary progressive visual disorder.
Patient 72 yo F. with a Balint syndrome. Patient is totally unable to copy two squares. On coronal MRI, considerable atrophy at the level of visual cortex.

Alzheimer's disease

Alzheimer case from the neuropathologic collection Yakovlev-Haleem. AFIP. Washington

Pr. AD in a 73yo patient with memory deficit and difficulty with spatial orientation.



In Alzheimer's disease, there is an atrophy of the parietal cortex as well as of the hippocampal structures or the temporal and frontal cortex. In general, there is no atrophy and few tangles at the level of the primary visual cortex.