TEMPORAL LOBE ANATOMY

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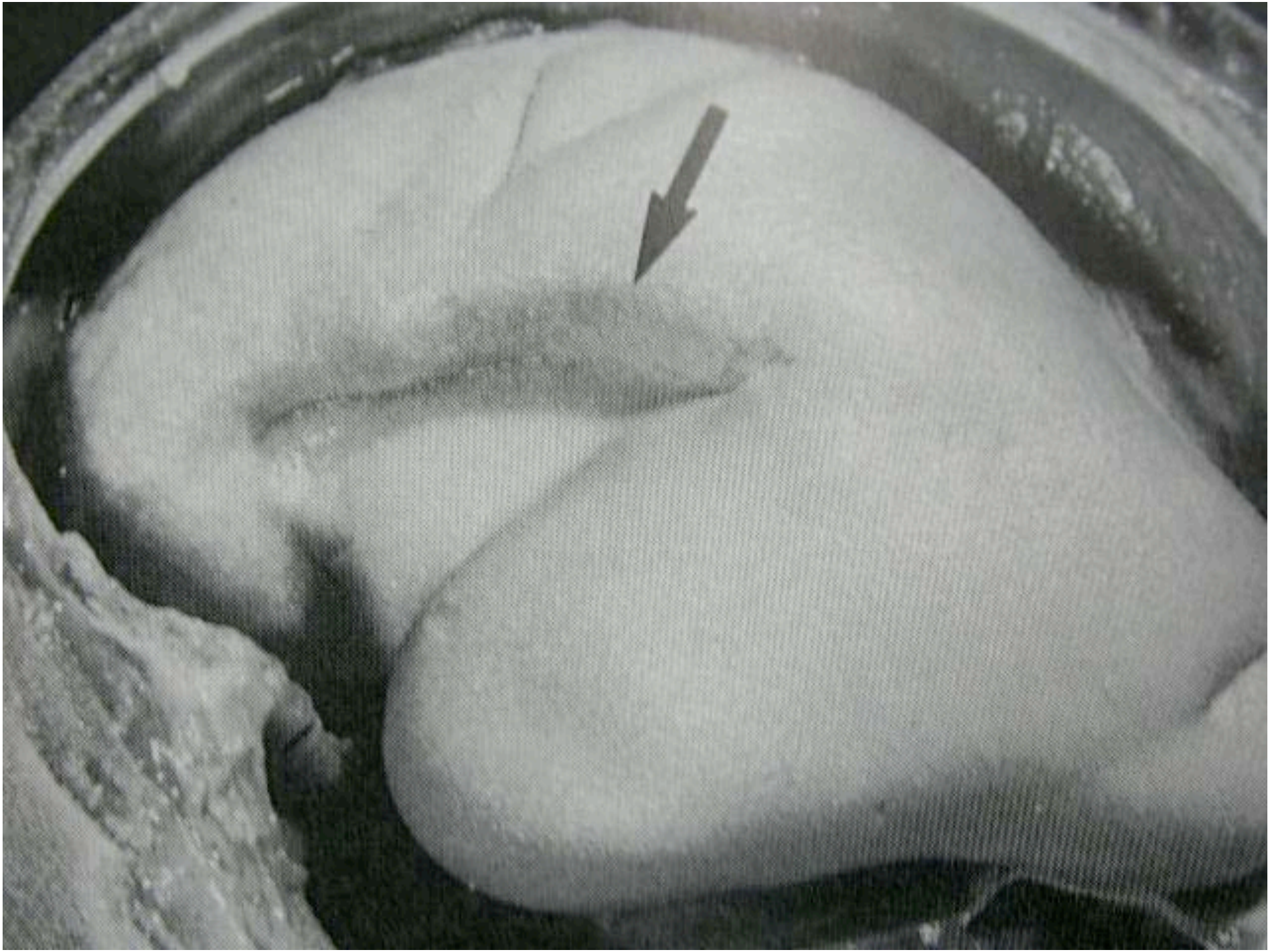
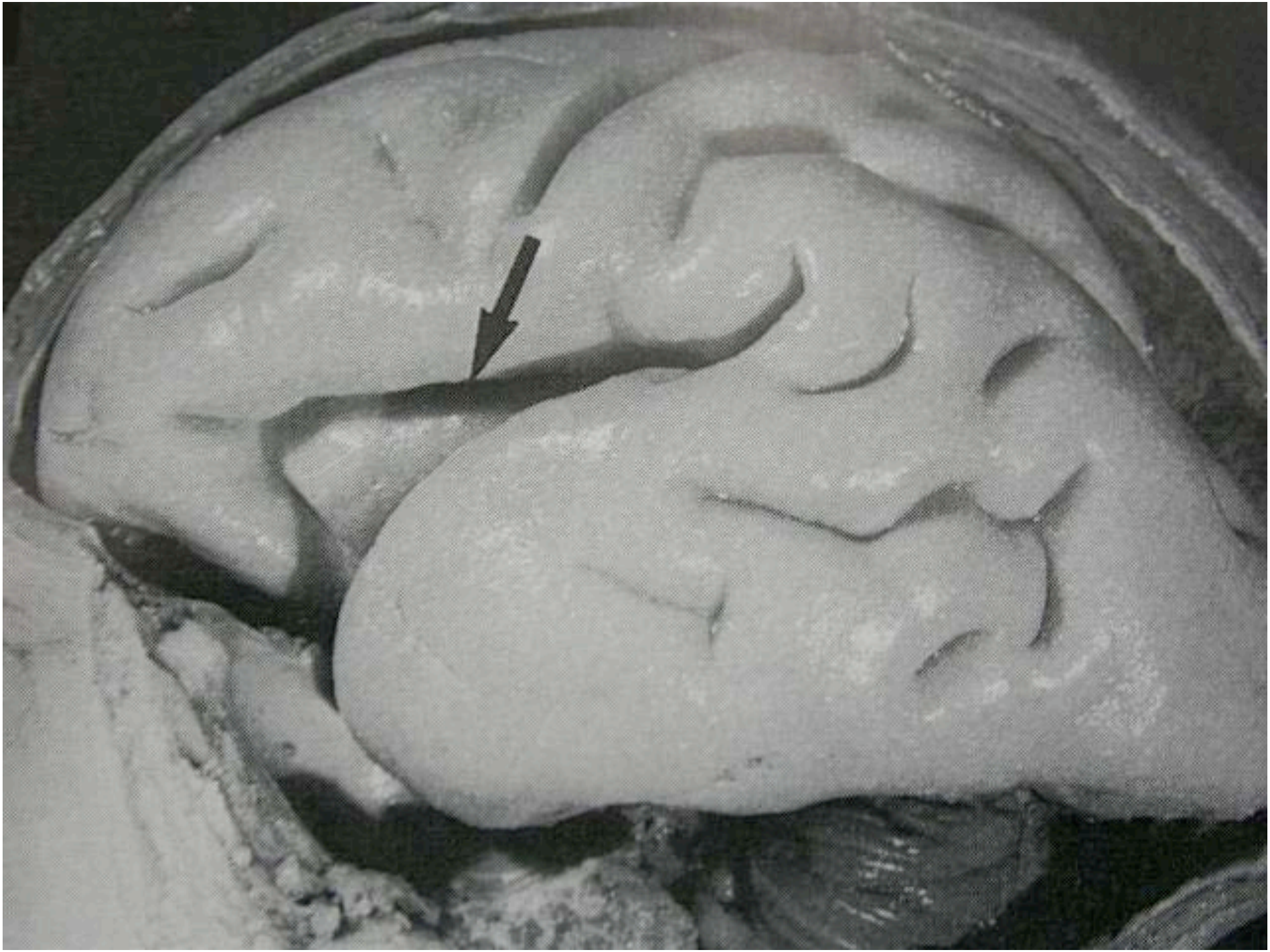
NEUROLOGICAL SURGERY.
KAUH.

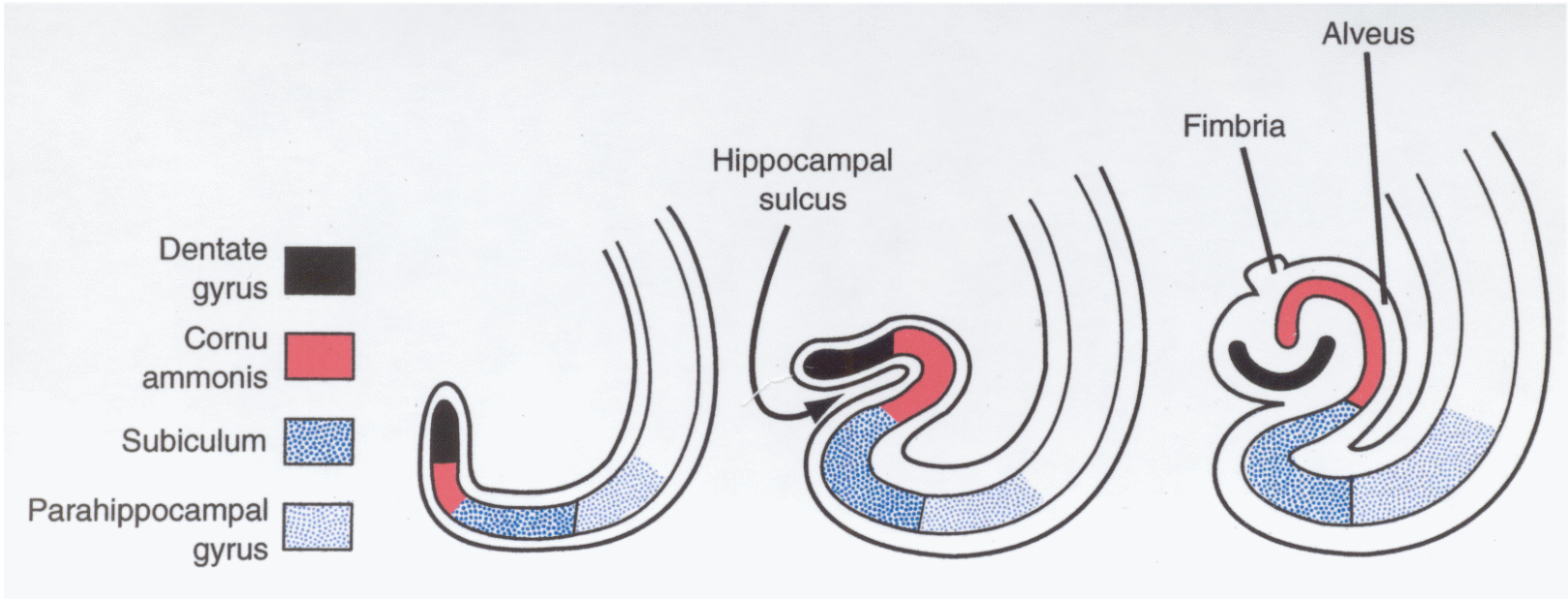
Embryology of the temporal lobe.

The appearance of the early features of the temporal lobe starts at the age of 11weeks.

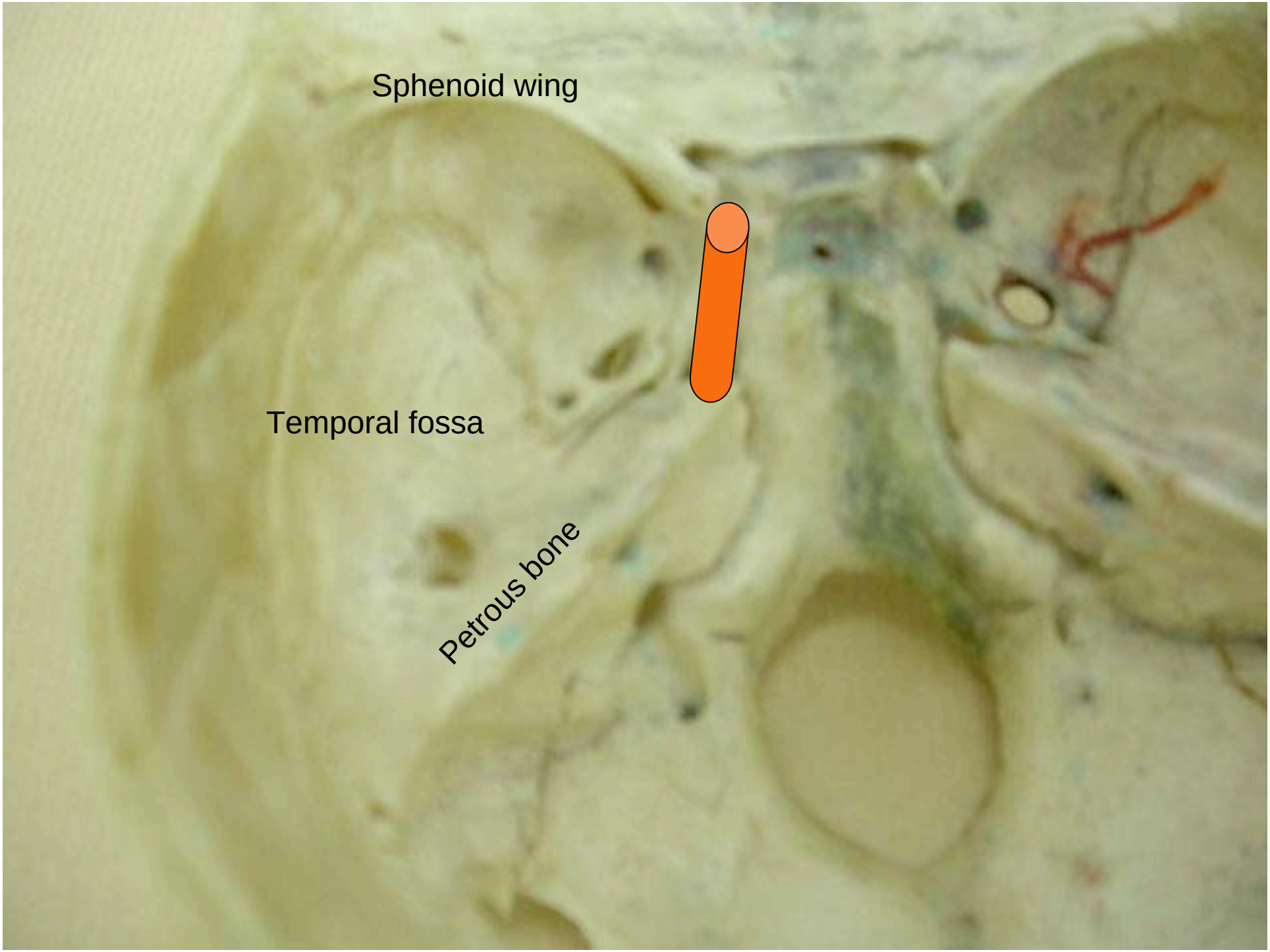
It measures 10 cm in adults.

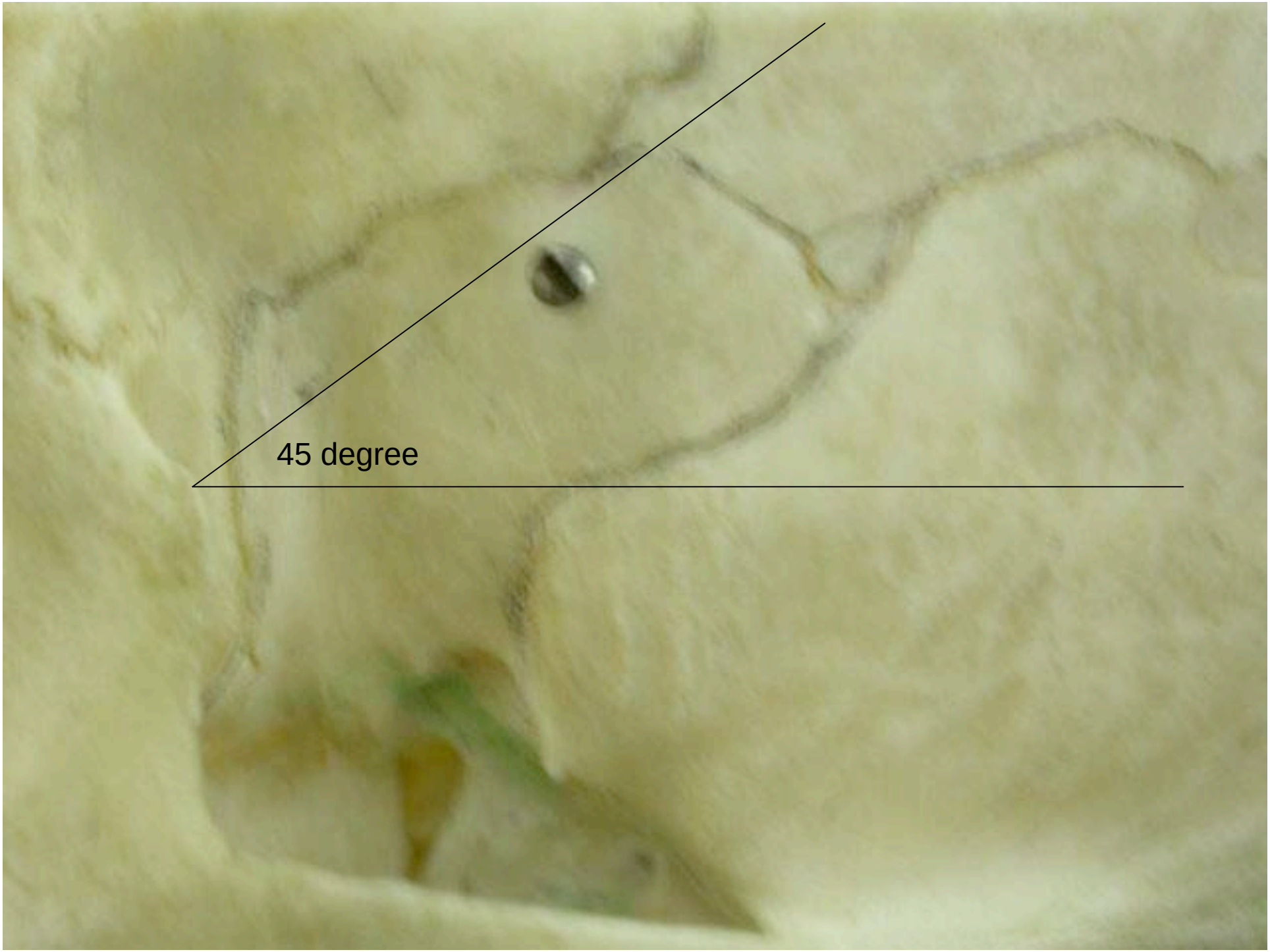


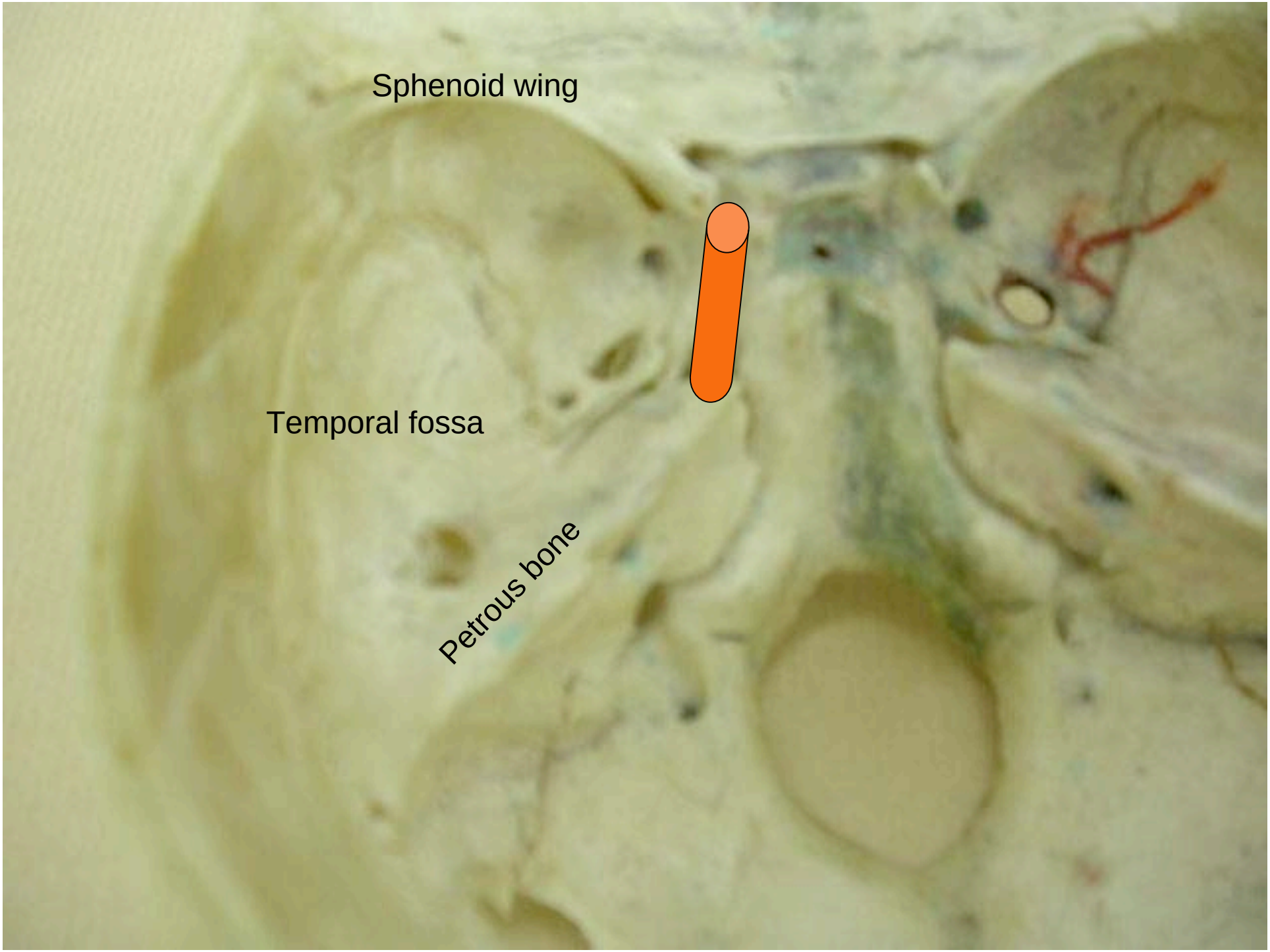


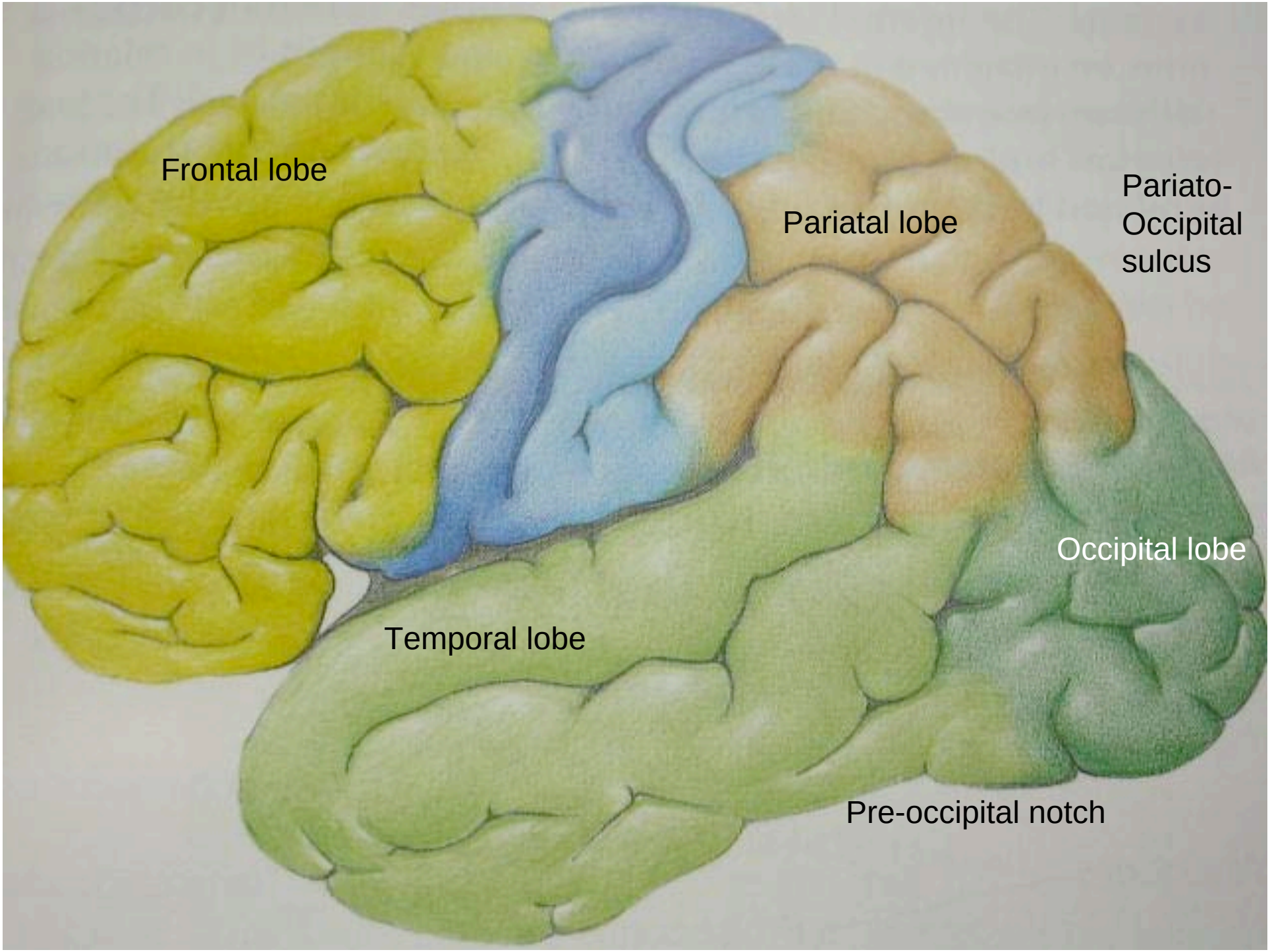

Dentate gyrus
Cornu ammonis
Subiculum
Parahippocampal gyrus
Hippocampal sulcus
Fimbria
Alveus

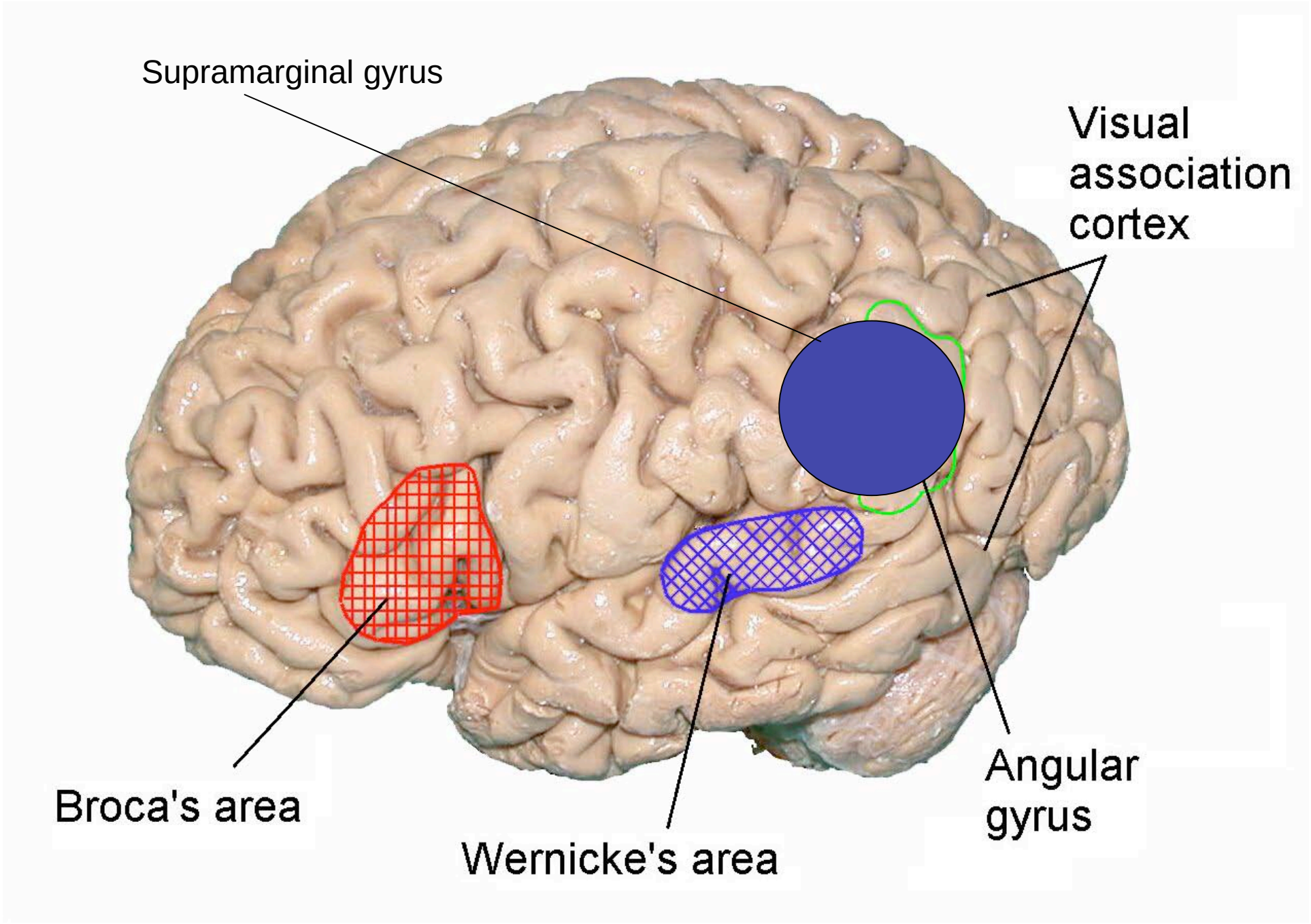
Surface anatomy of the temporal lobe.

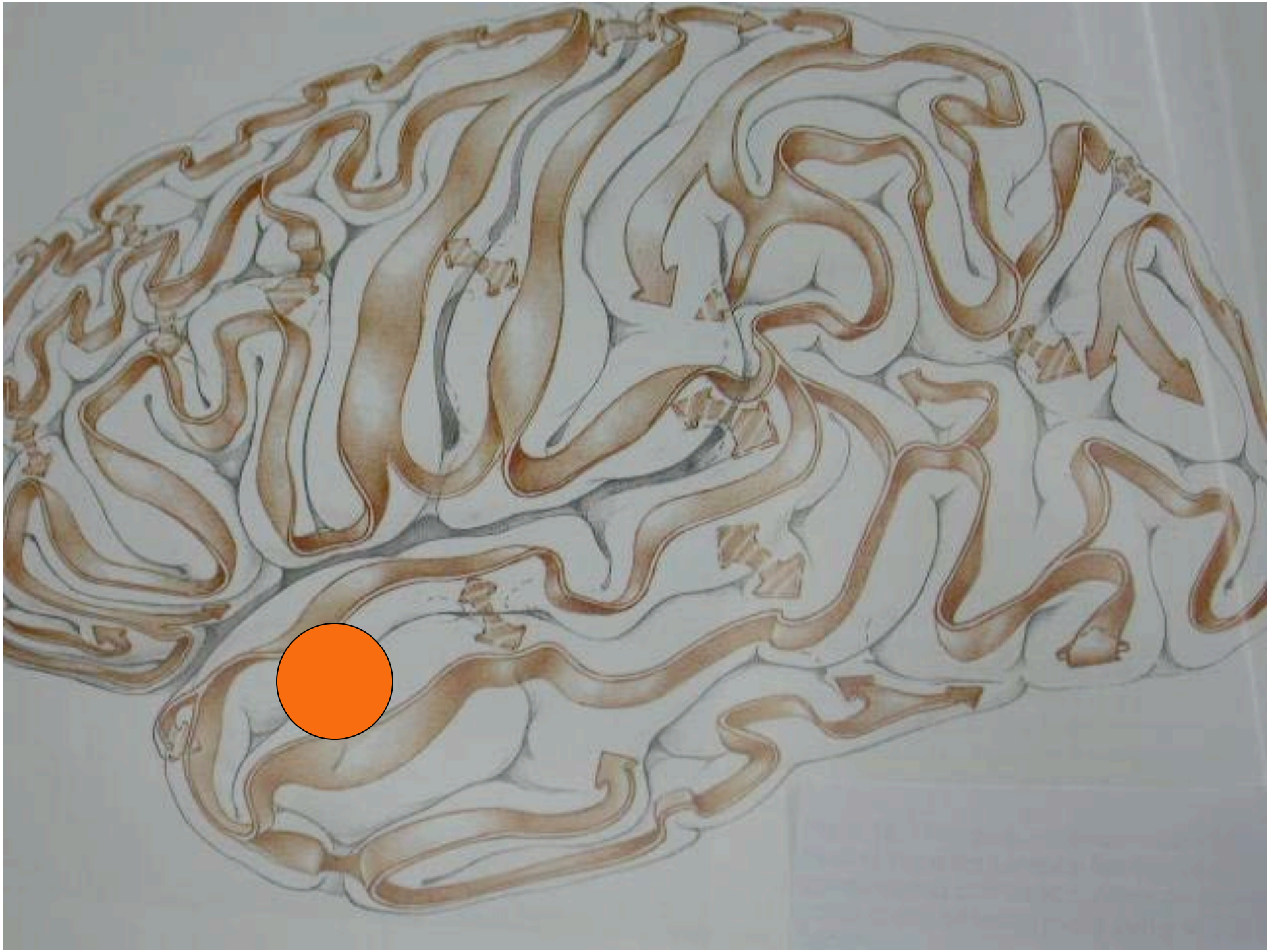

Sphenoid wing
Temporal fossa
Petrous bone

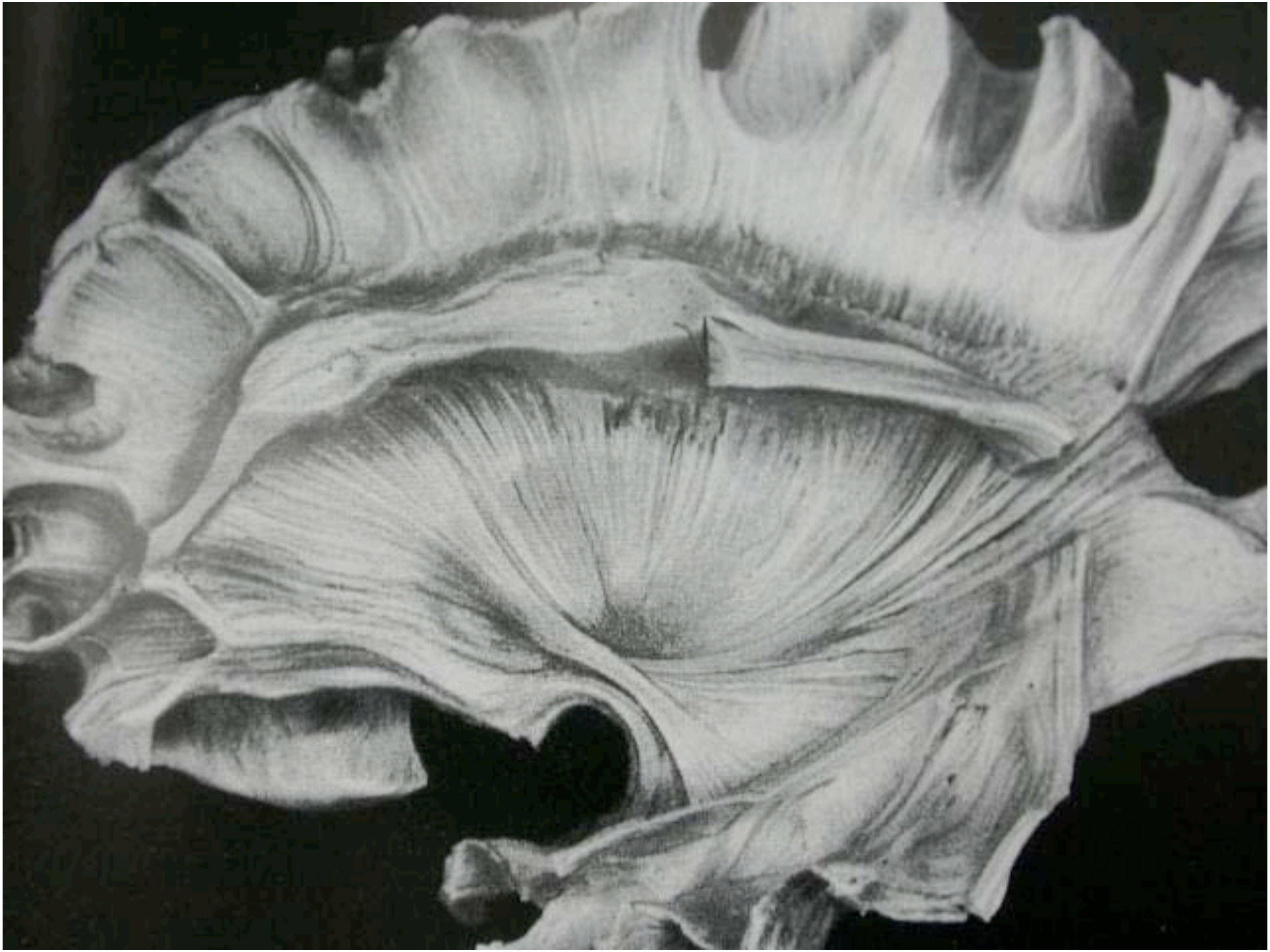

45 degree

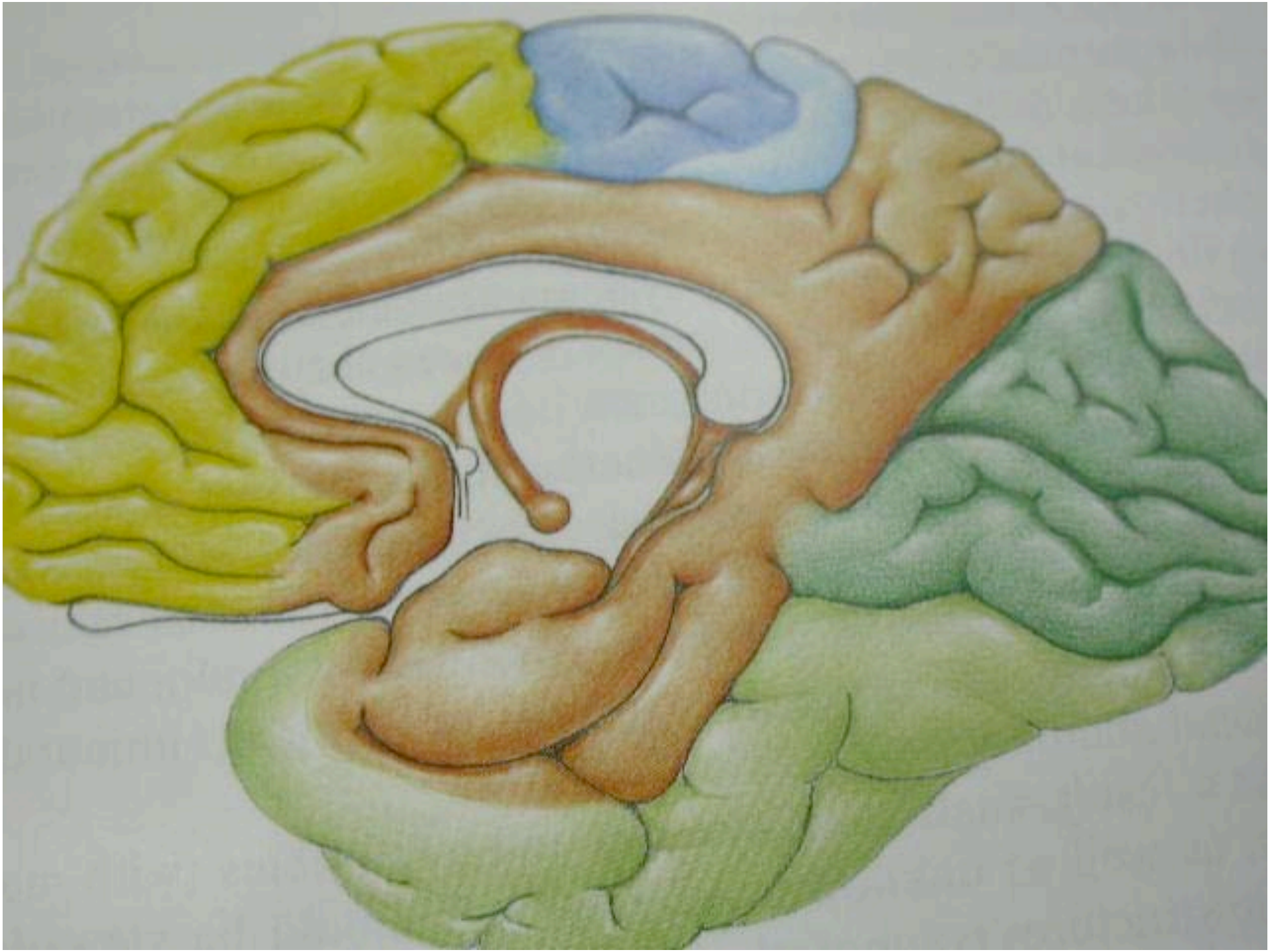

Sphenoid wing
Temporal fossa
Petrous bone

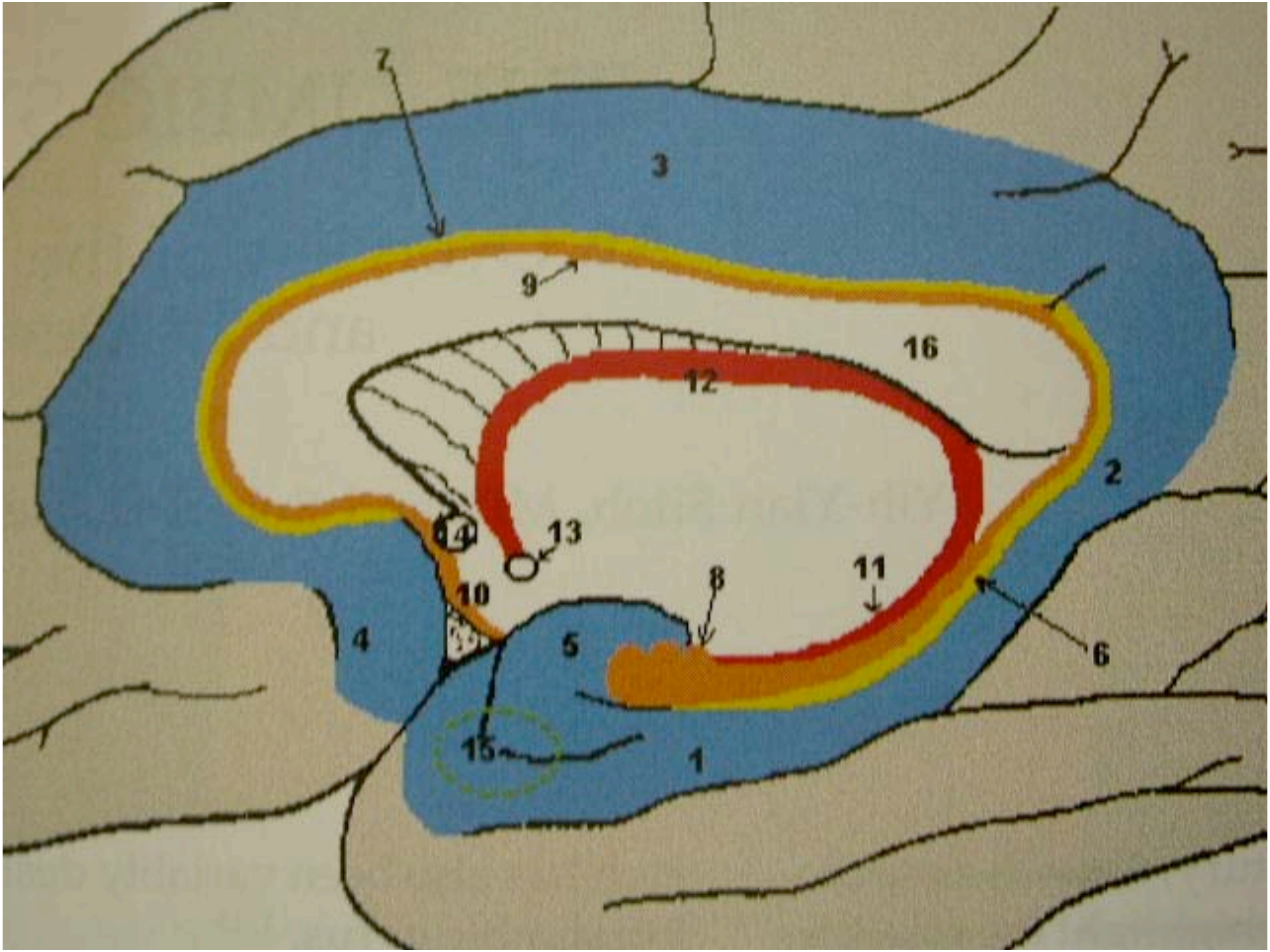

Frontal lobe
Pariatal lobe
Pariato-
Occipital
sulcus
Occipital lobe
Temporal lobe
Pre-occipital notch


Supramarginal gyrus
Visual association cortex
Broca's area
Wernicke's area
Angular gyrus





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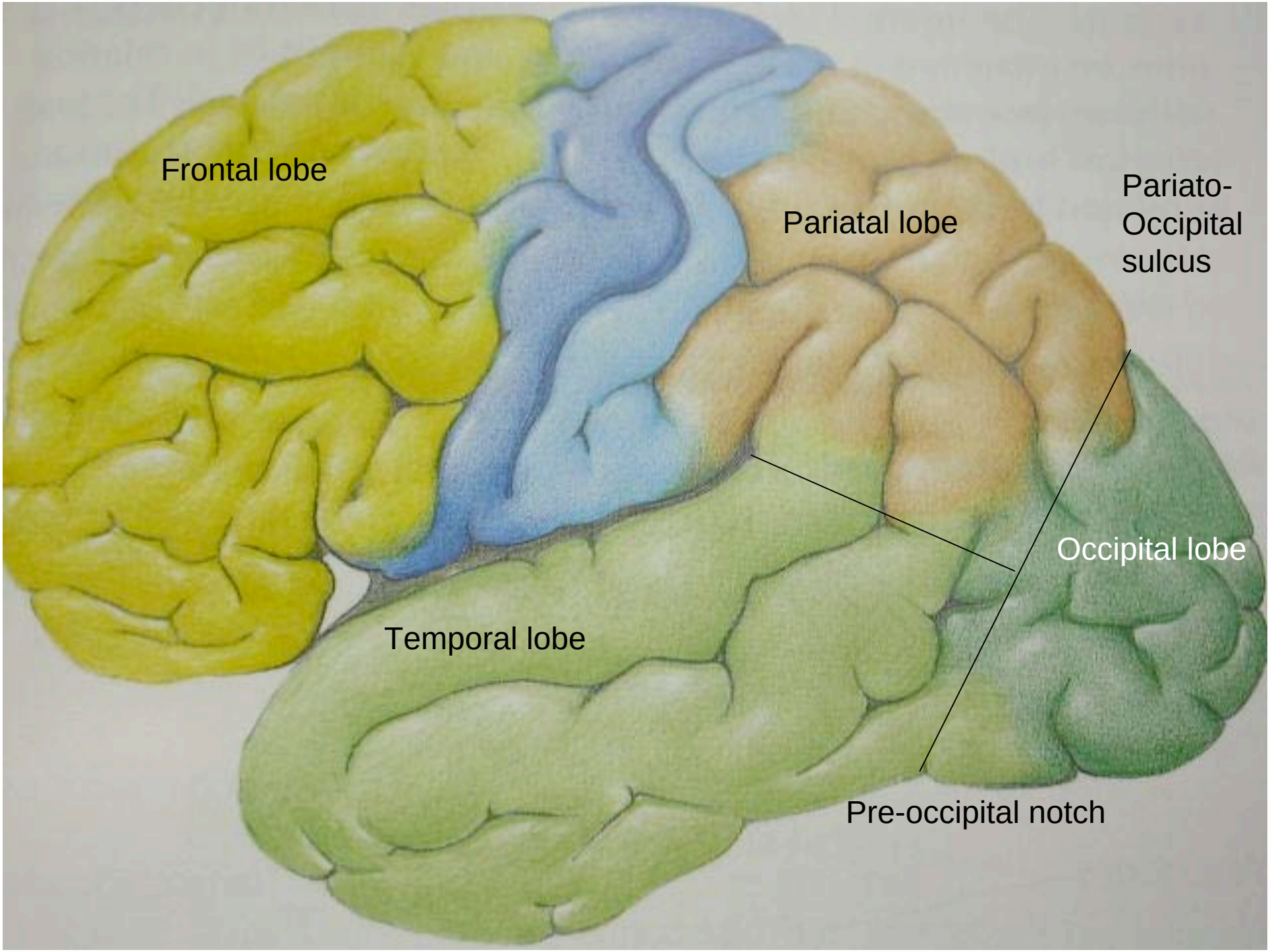
- The posterior boundary of the temporal lobe is not a true boundary


Frontal lobe
Pariatal lobe
Pariato-
Occipital
sulcus
Occipital lobe
Temporal lobe
Pre-occipital notch

The Anterior occipital sulcus.

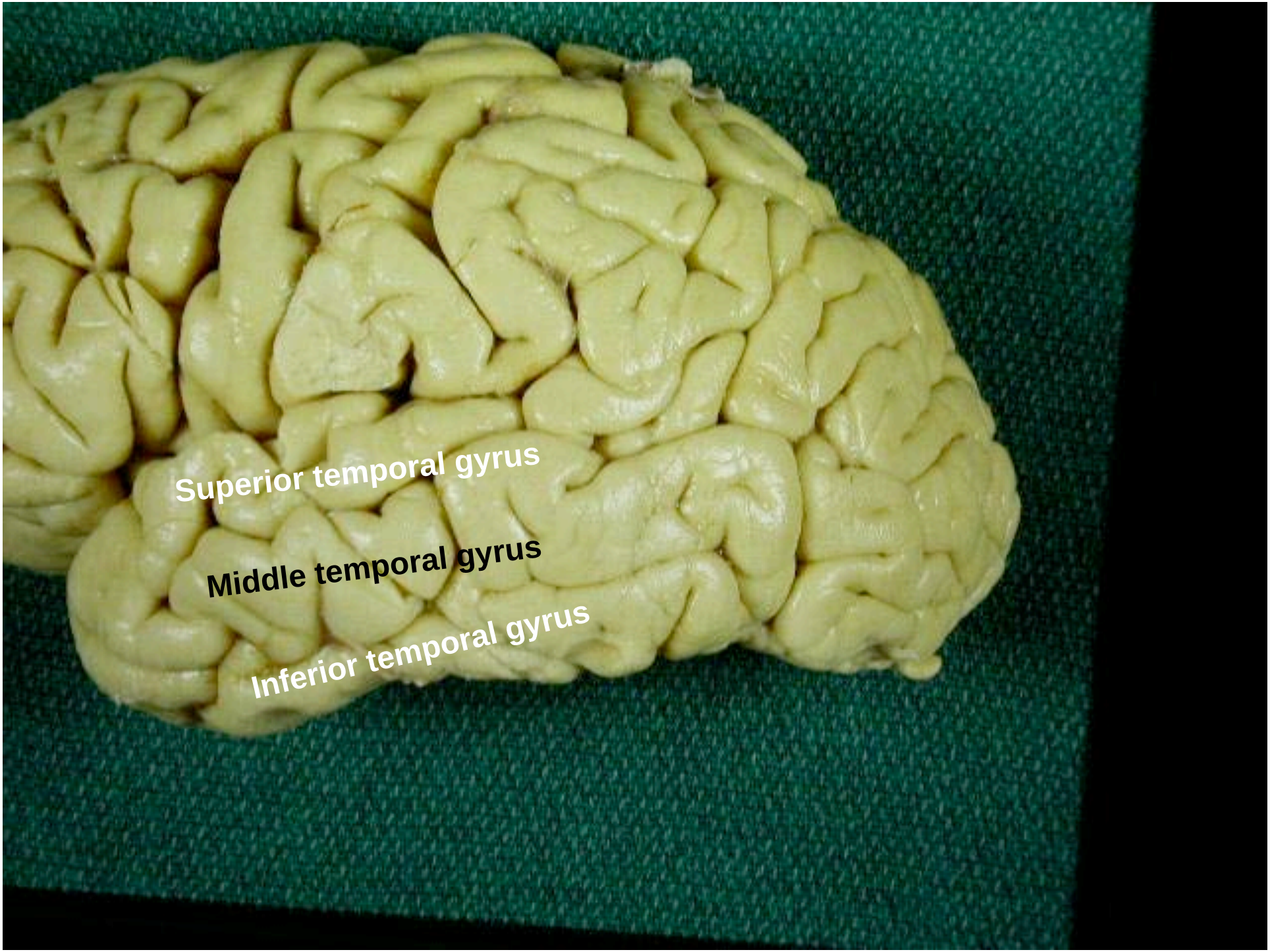
- Addas.B, Clarke.D. The forgotten sulcus.

- 50 hemispheres.
- 25 males and 25 females
- 10% of brains

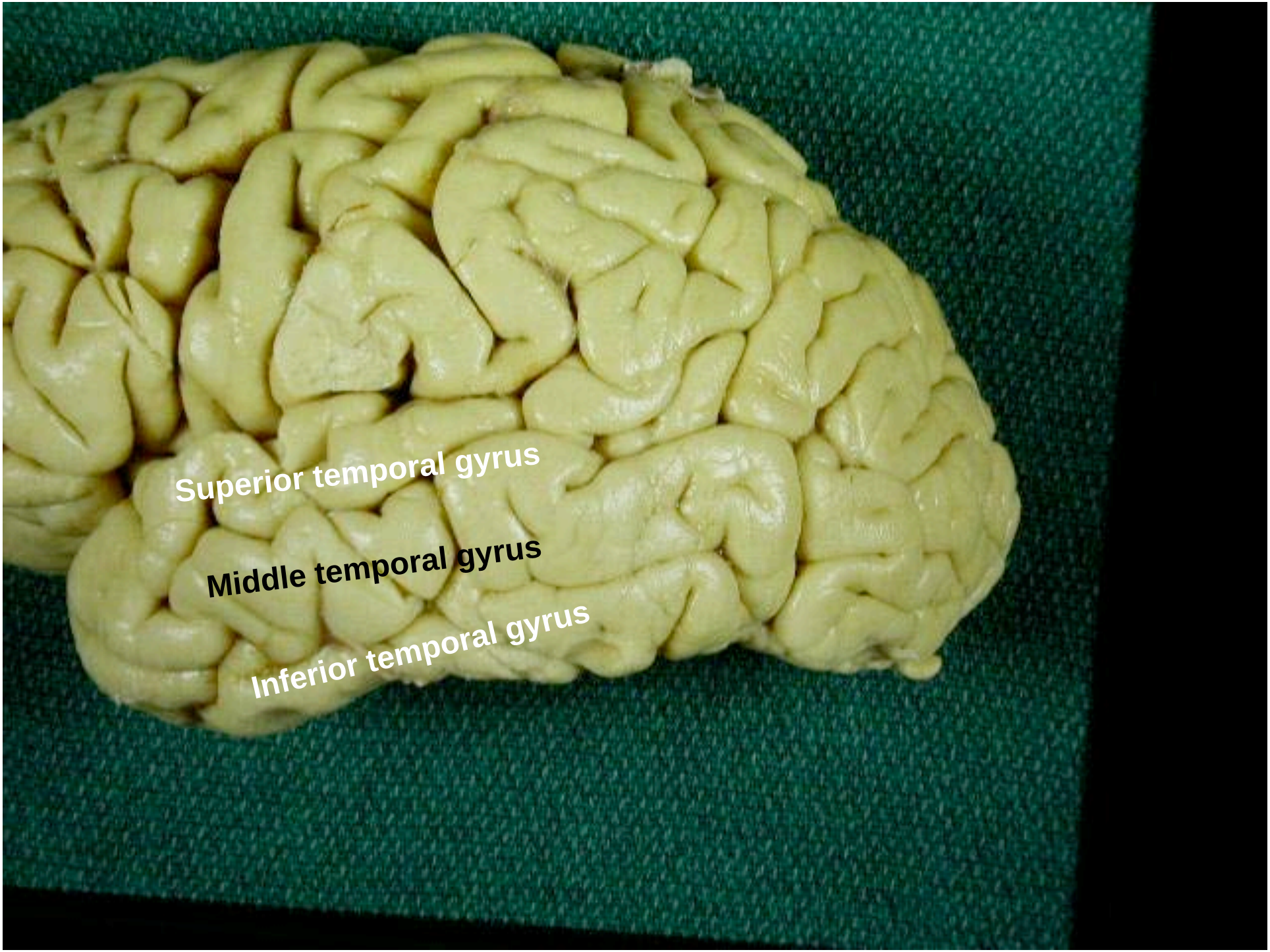
Parenchymal anatomy of the temporal lobe.

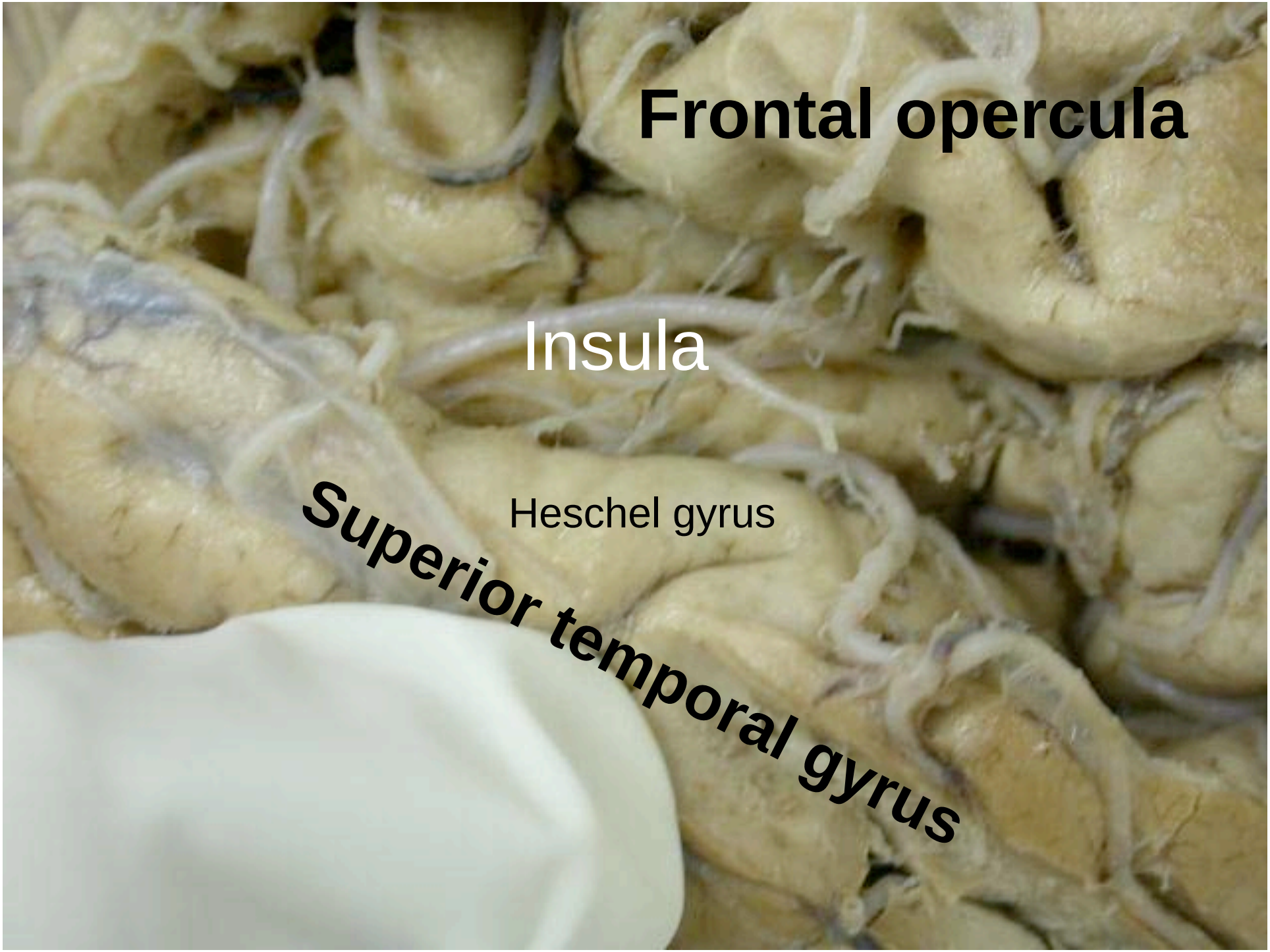
The temporal lobe.

- Divided into two major units
  - Lateral
    - Superior, middle, inferior gyri
  - Mesiobasal.
    - Occipto-temporal gyrus (fusiform gyrus)
    - Parahippocampal gyrus.
    - Hippocamus and amygdala

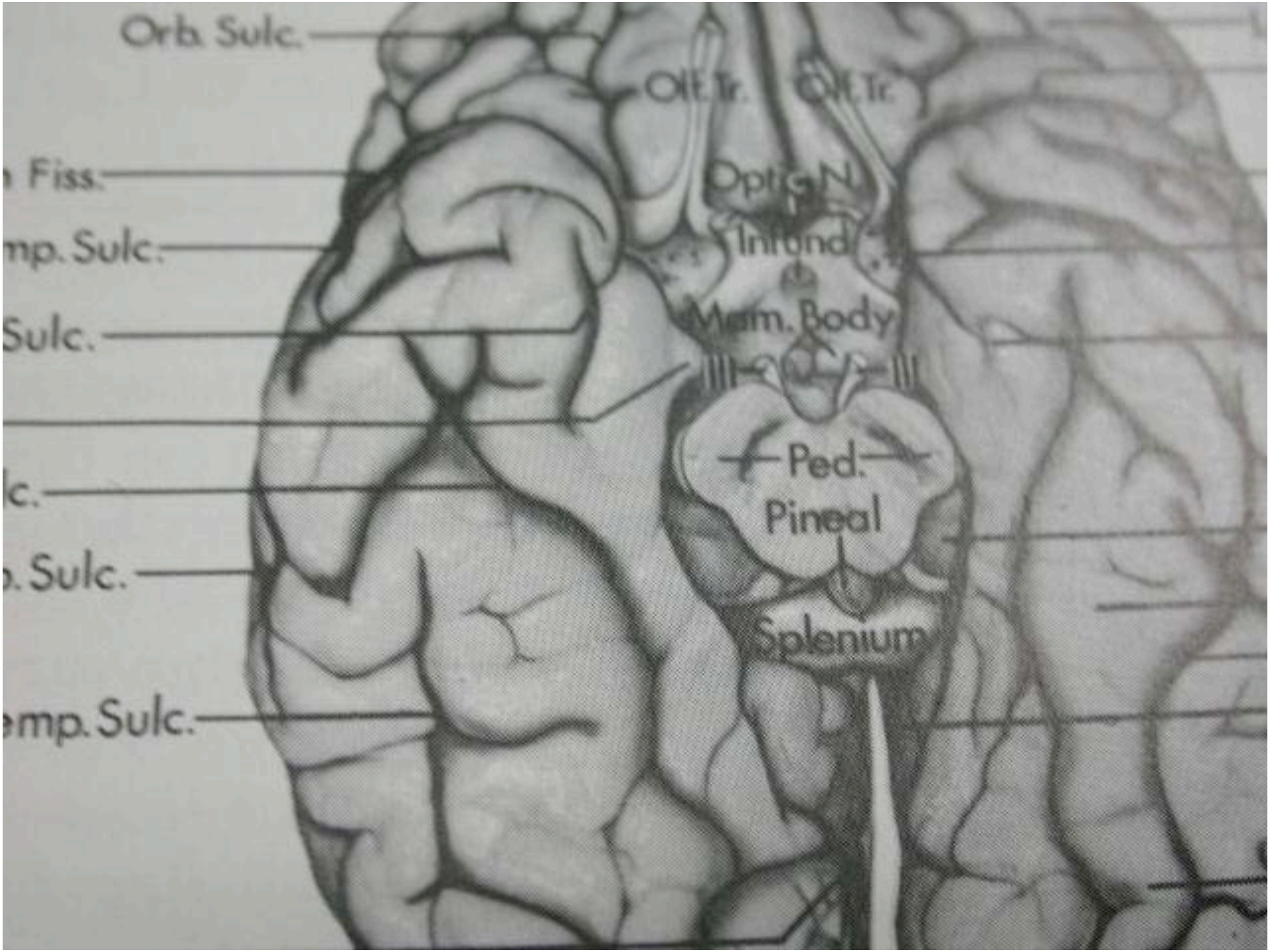

Superior temporal gyrus
Middle temporal gyrus
Inferior temporal gyrus

Superior temporal gyrus.


Superior temporal gyrus
Middle temporal gyrus
Inferior temporal gyrus


Frontal opercula
Insula
Heschel gyrus
Superior temporal gyrus

Inferior aspect.


Orb. Sulc.
Olf. Tr.
Olf. Tr.
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mp. Sulc.
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emp. Sulc.
Optic N.
Infund.
Mam. Body
Ped.
Pineal
Splenium


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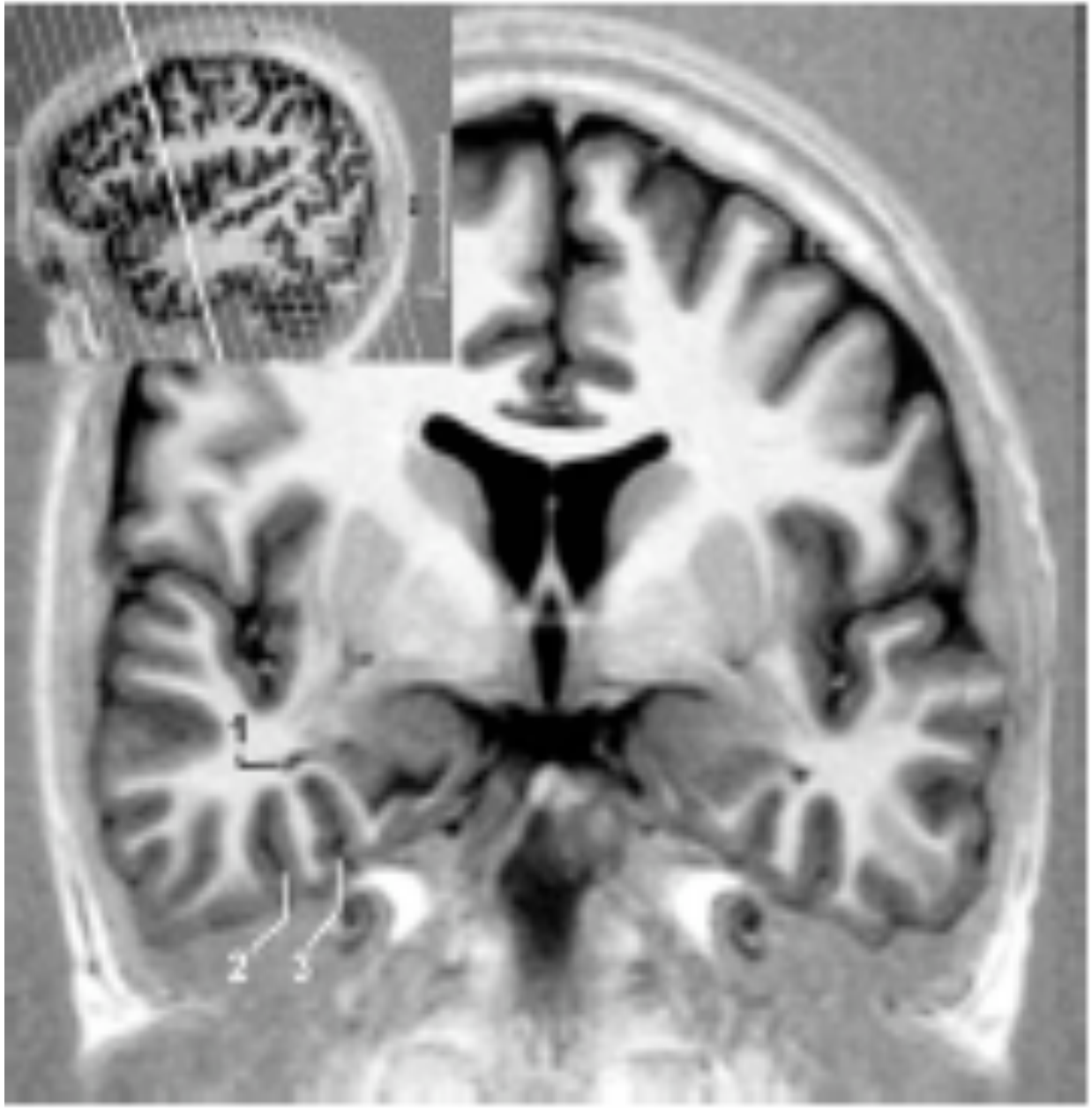
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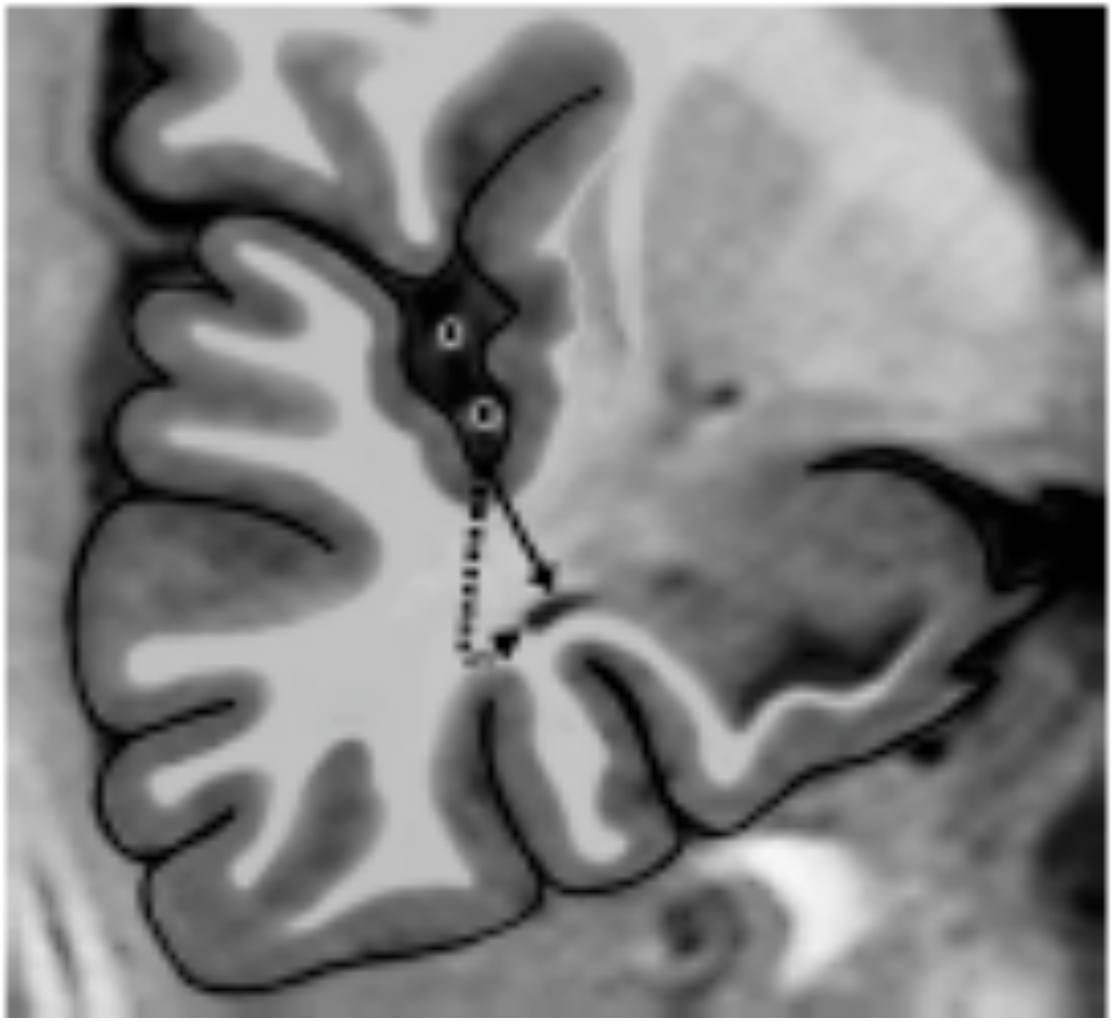
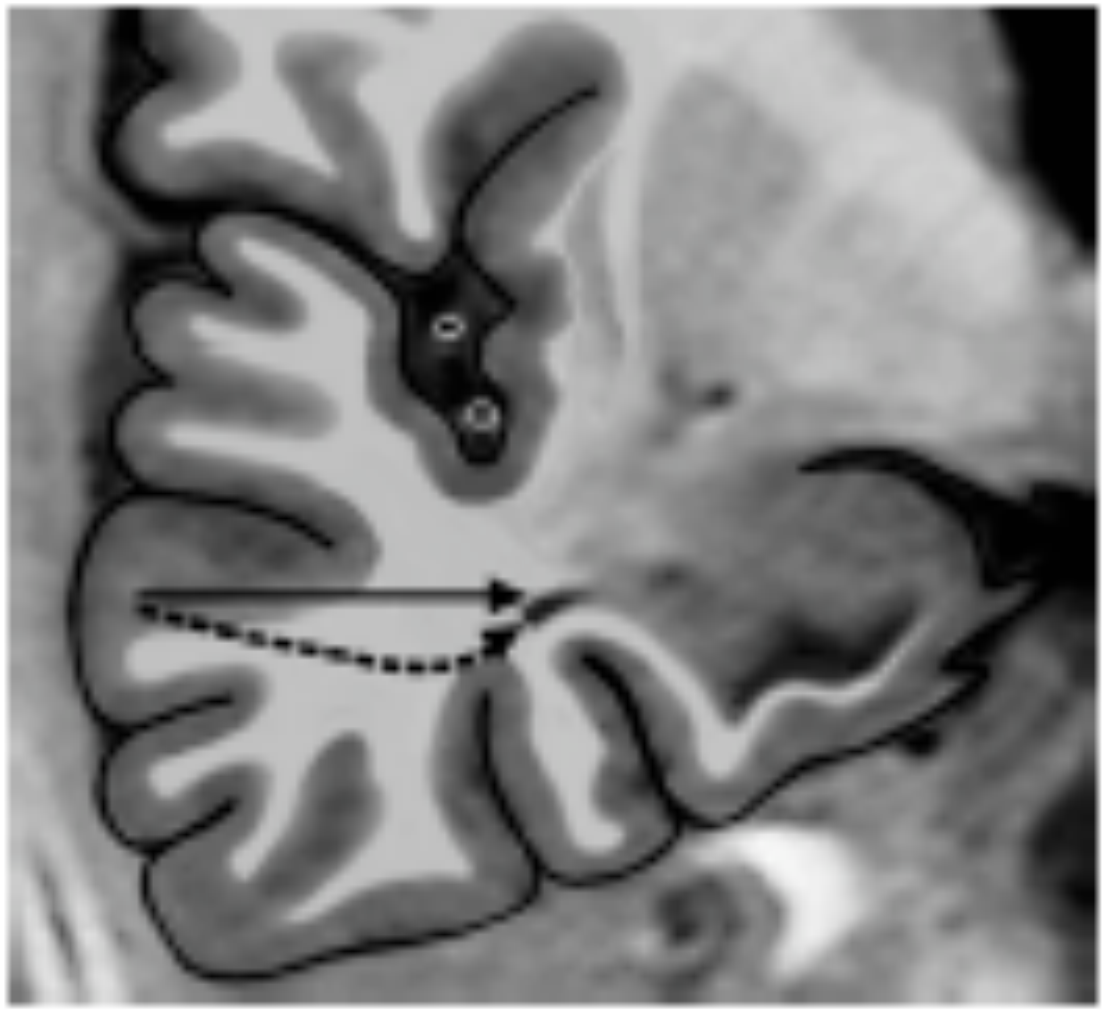
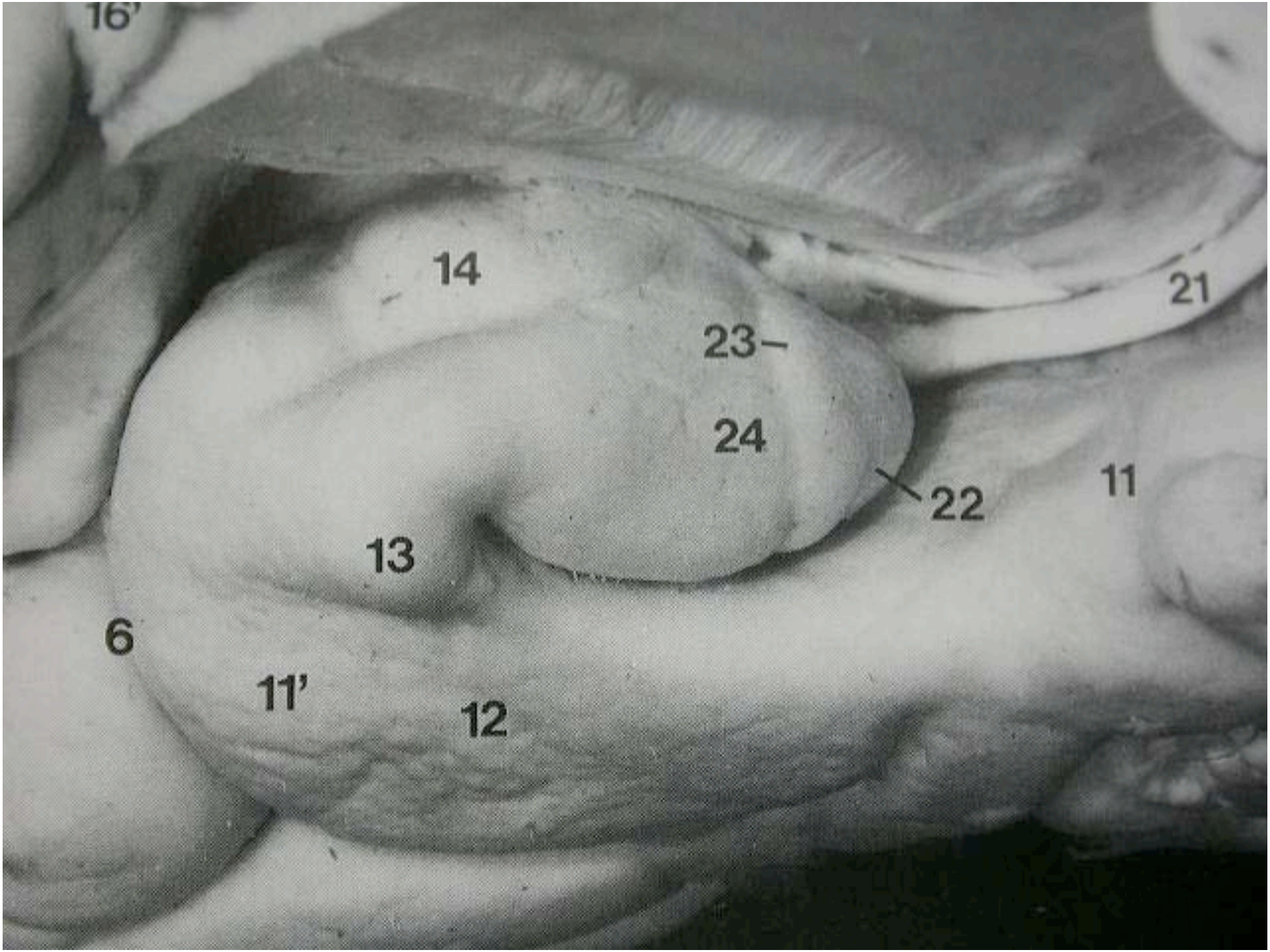




Mesial aspect.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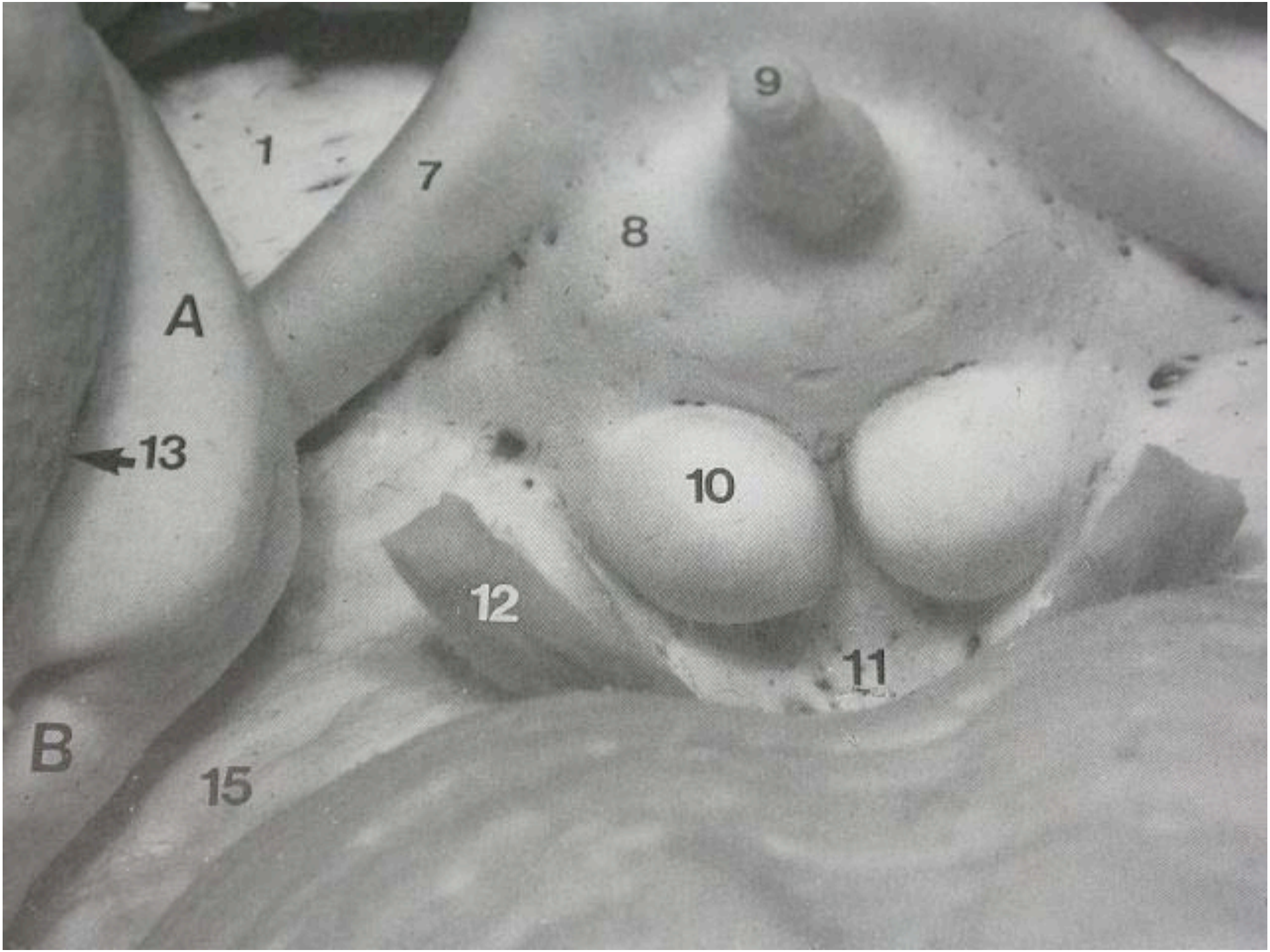
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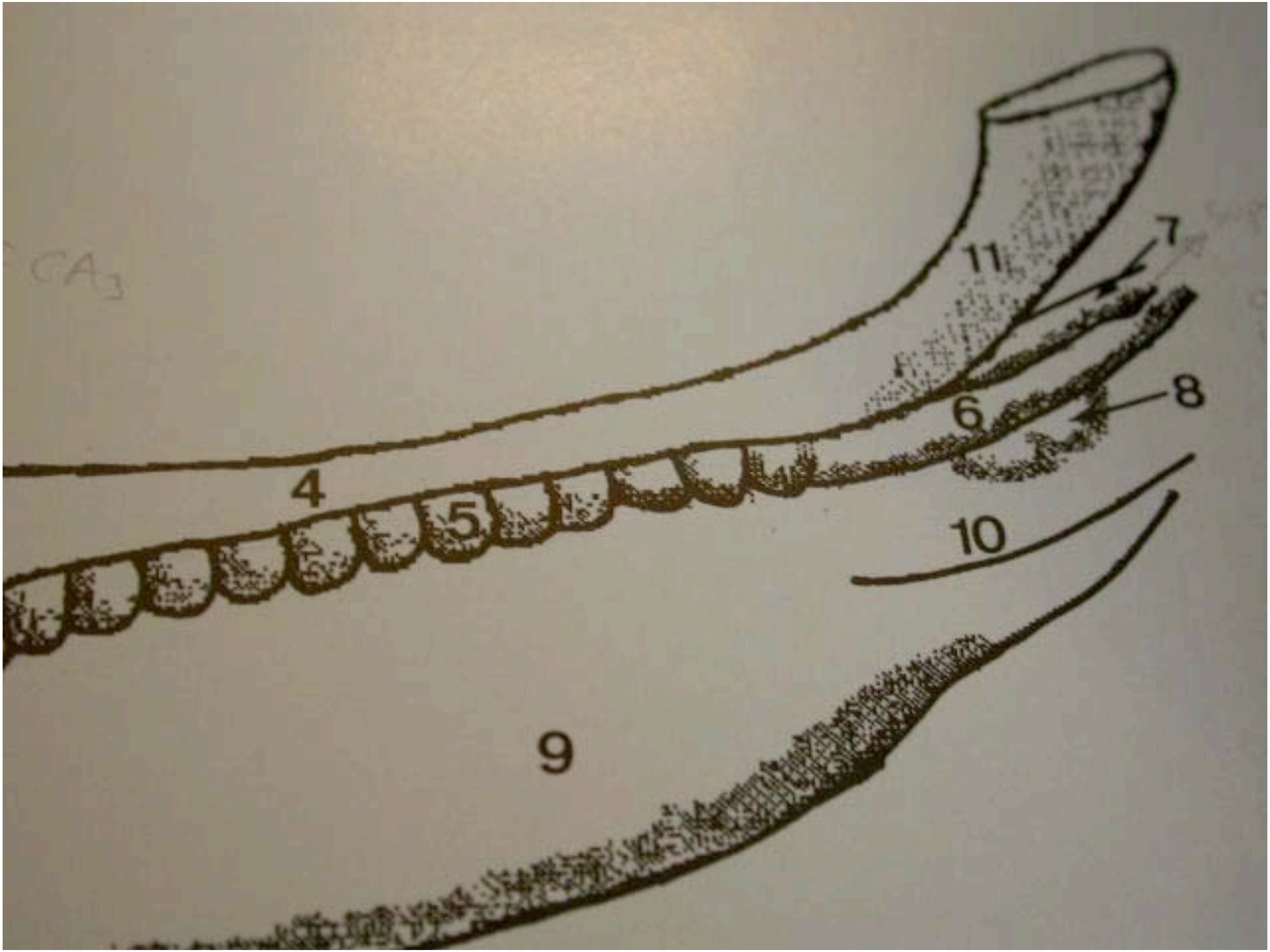
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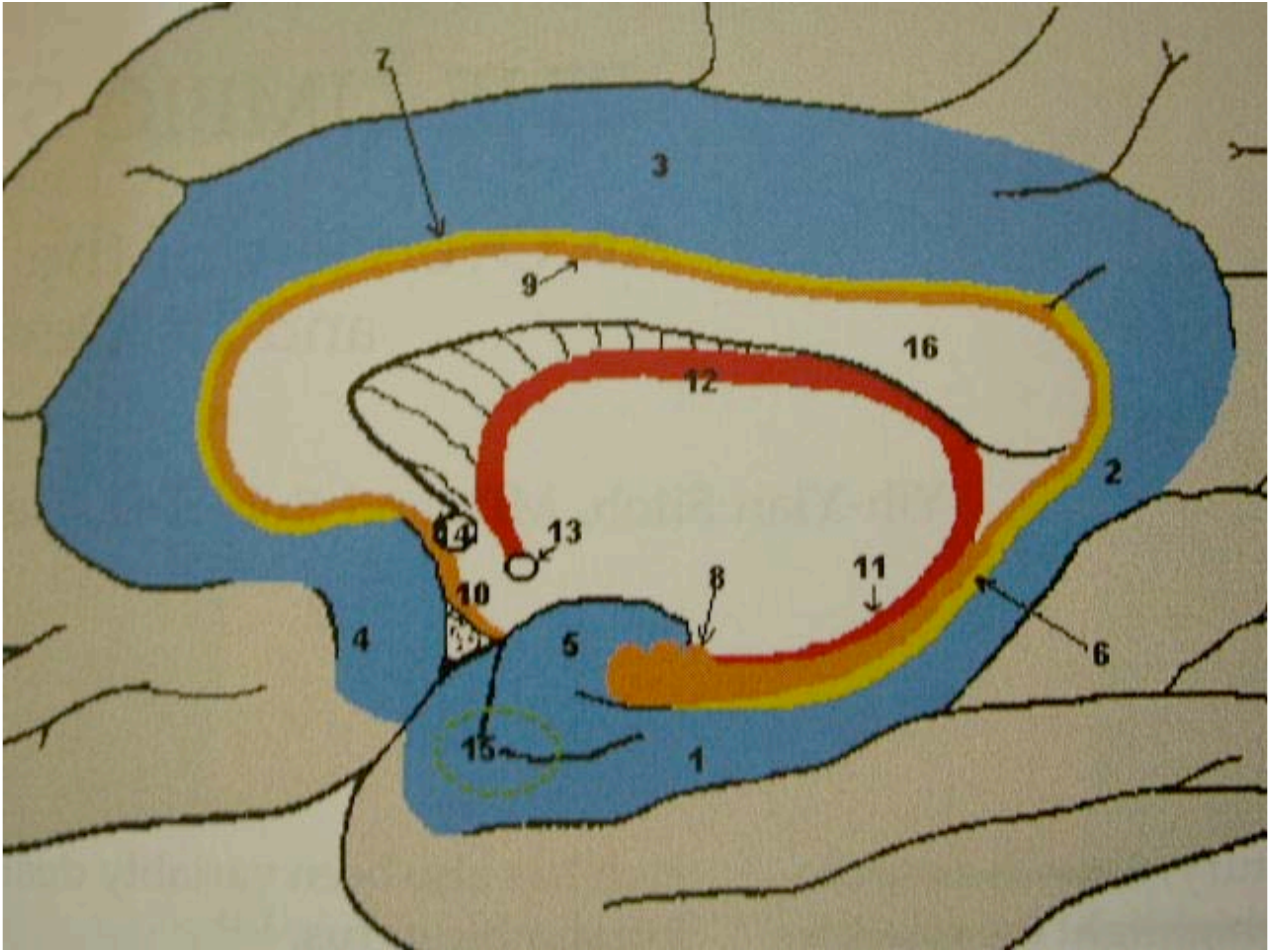
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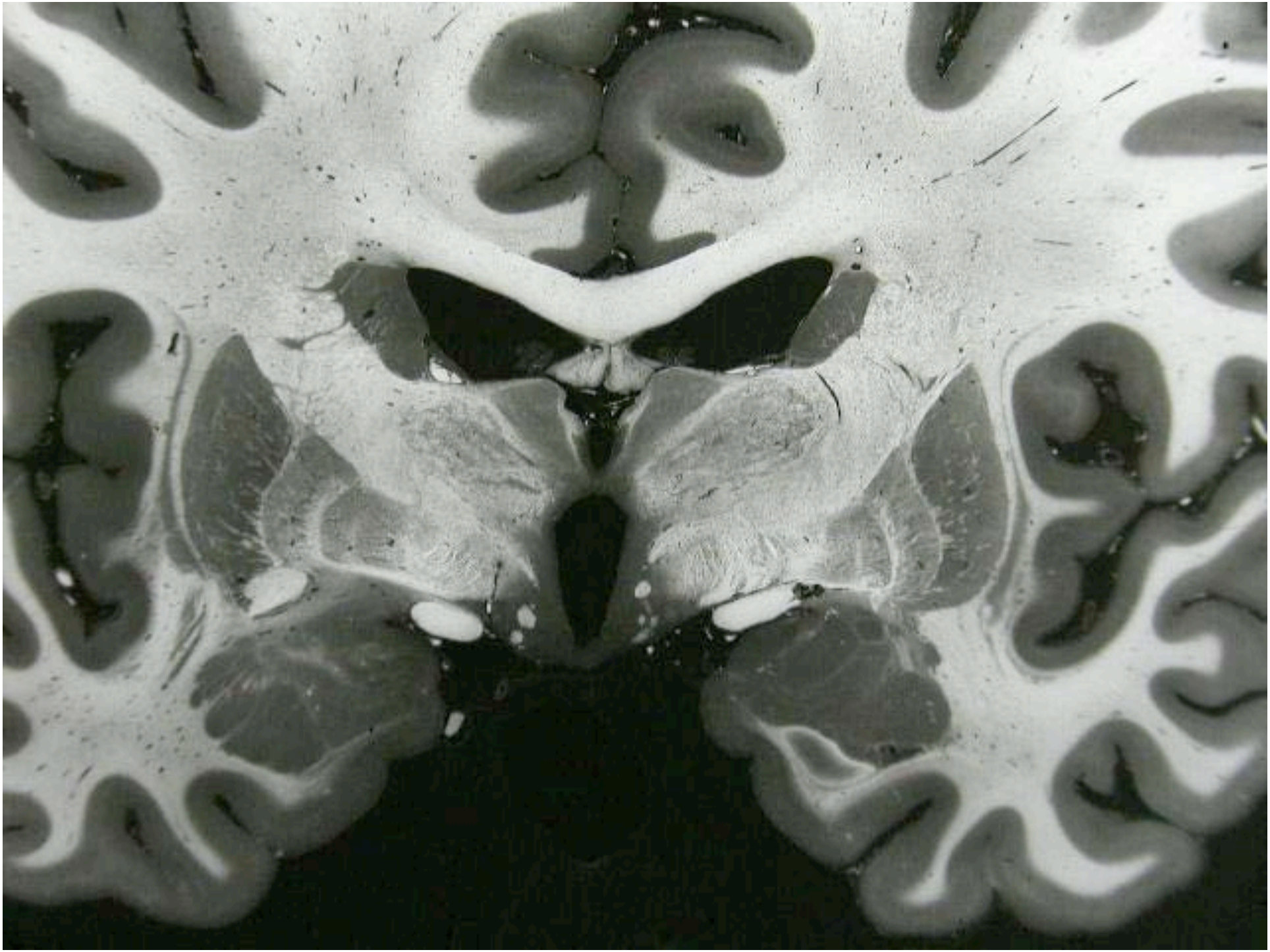
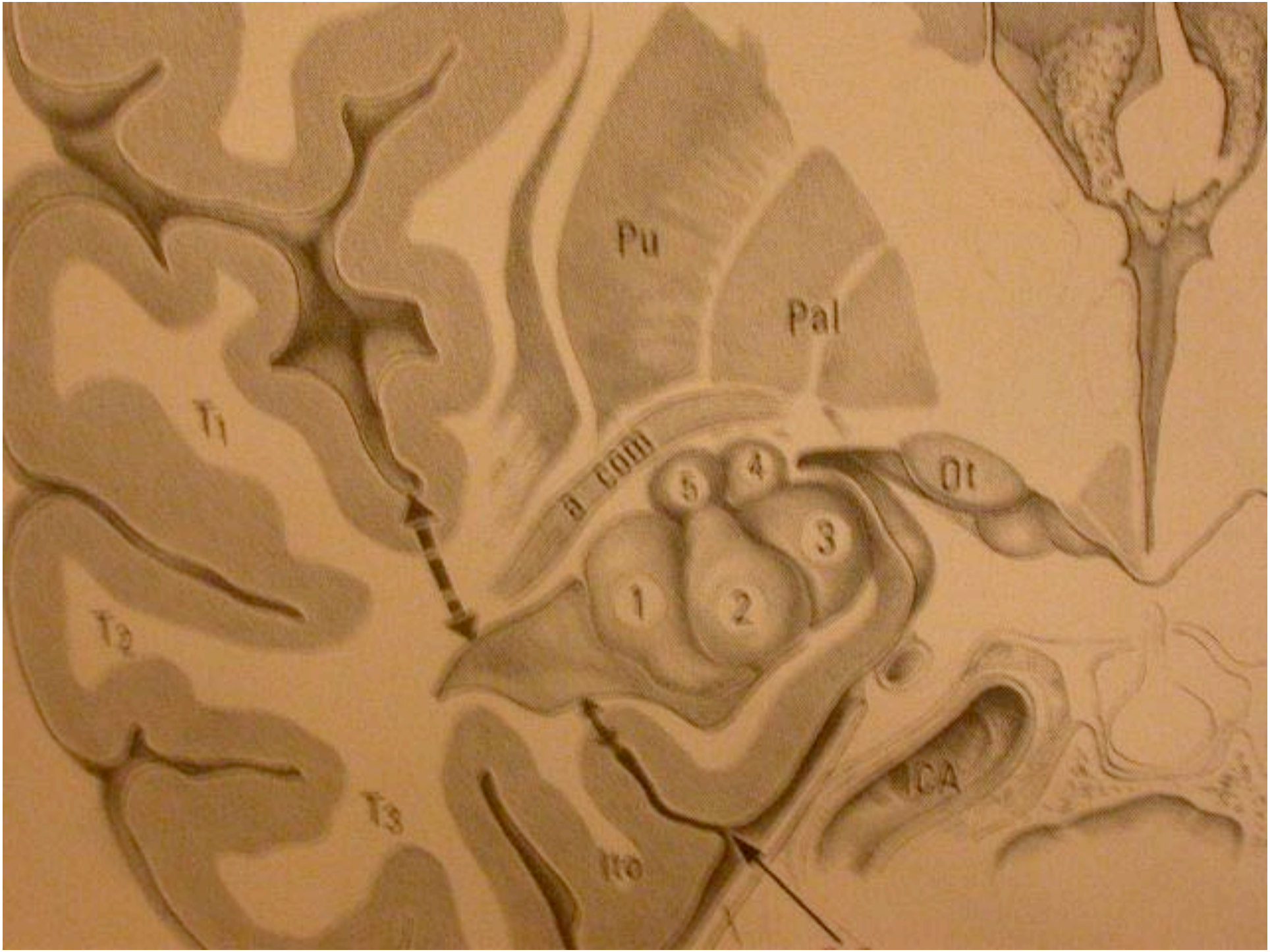
The Amygdala (Almond)

– Group of nuclei taking the shape of an almond.

– Situated between the anterior end of the temporal horn and the ventral surface of the lentiform nucleus.

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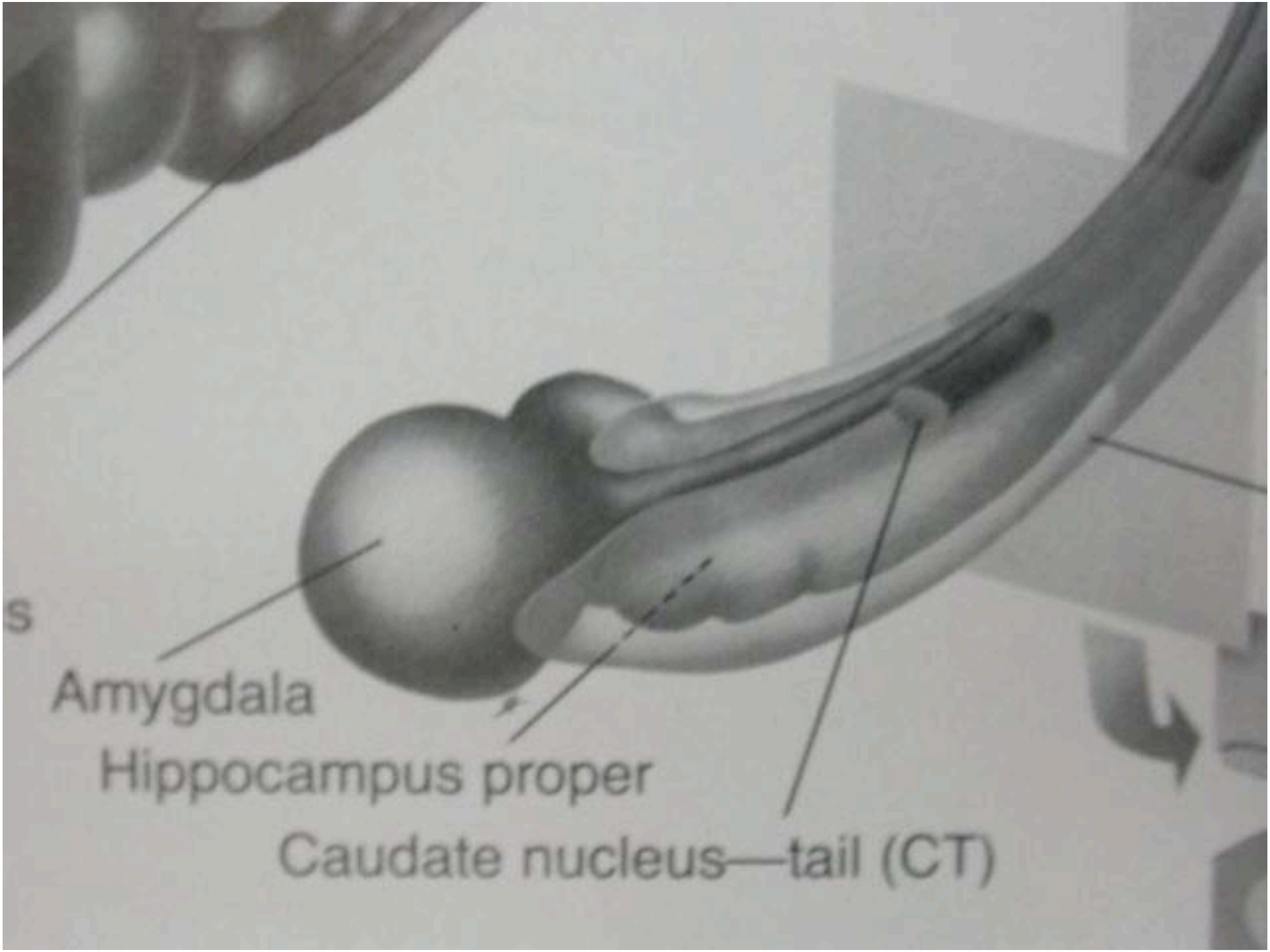

s
Amygdala
Hippocampus proper
Caudate nucleus—tail (CT)

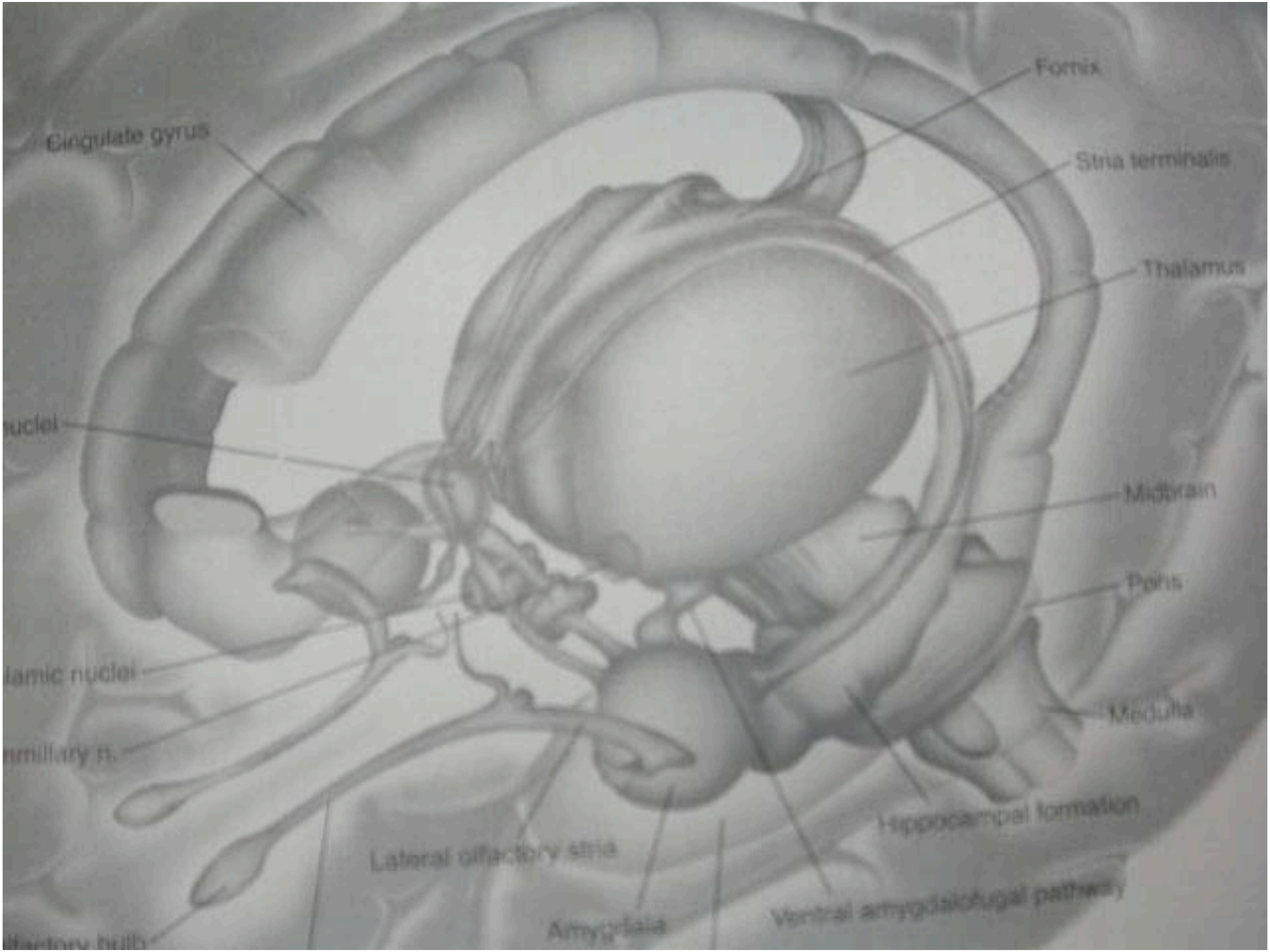
Amygdala connections

- Afferent from
  - Olfactory cortex
  - Information from the external environment concerning the frontal, parietal and temporal lobes.

  - Viscero-sensory afferents from
    - Tractus solitarious
    - Dorsal motor nucleus of the vagus nerve.

Amygdala connections.

- Efferents to
  - Amygdalofugal pathway to the thalamus and hypothalamus.
  - Stria terminalis


Fornix
Cingulate gyrus
Stria terminalis
Thalamus
uclei
Midbrain
Pons
lamic nuclei
Medulla
millary n.
Hippocampal formation
Lateral olfactory stria
Ventral amygdalofugal pathway
Amygdala

Functions

- Ingestion
- Aggression
- Reproduction
- Memory
- Learning

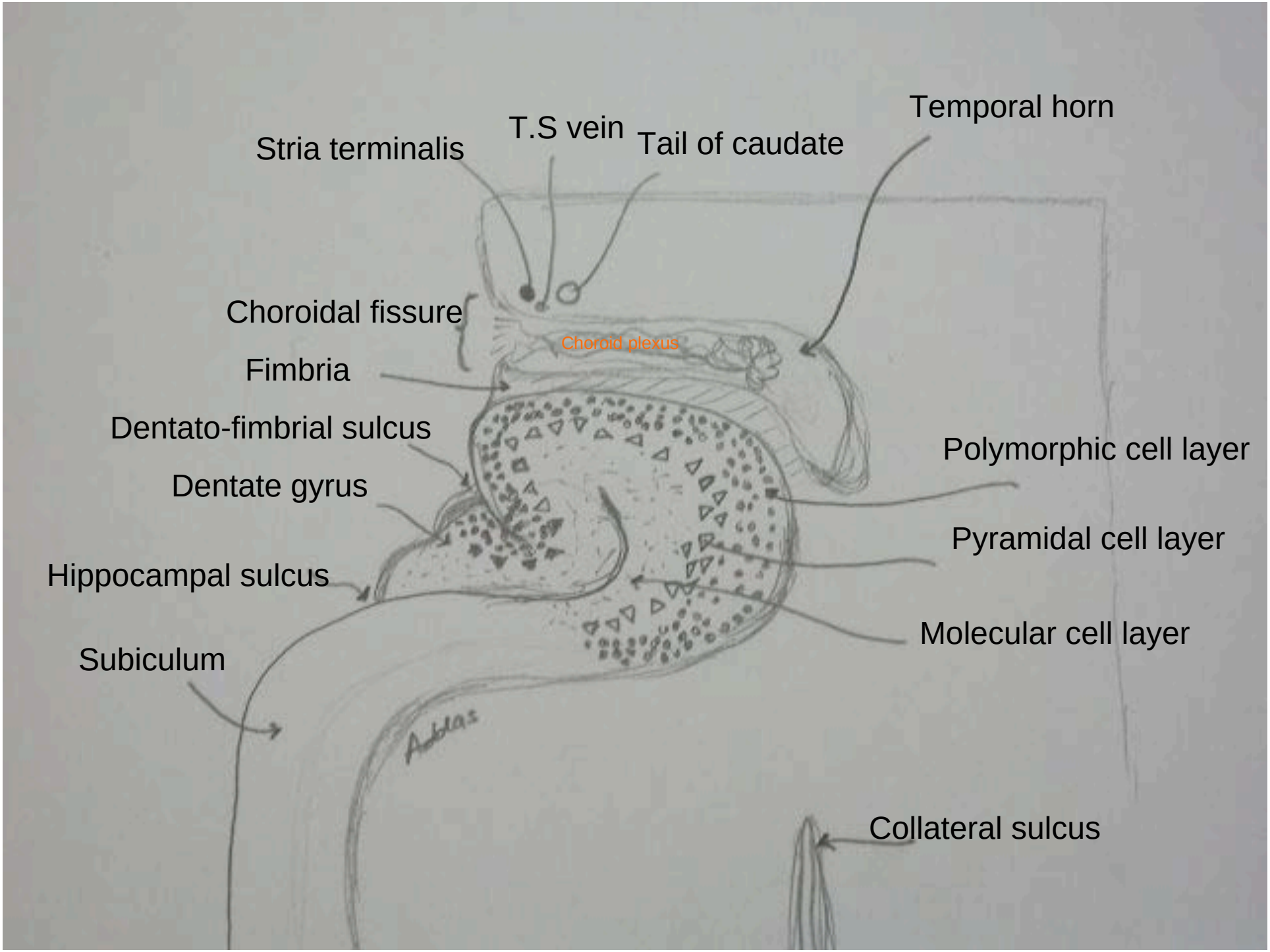
Clinical deficit

- Unilateral damage

- Bilateral damage
  - Psychic blindness, visual Agnosia.
  - Oral tendencies.
  - Hypermetamorphosis.
  - Emotional changes.
  - Hypersexualilty
  - Dietary habits.

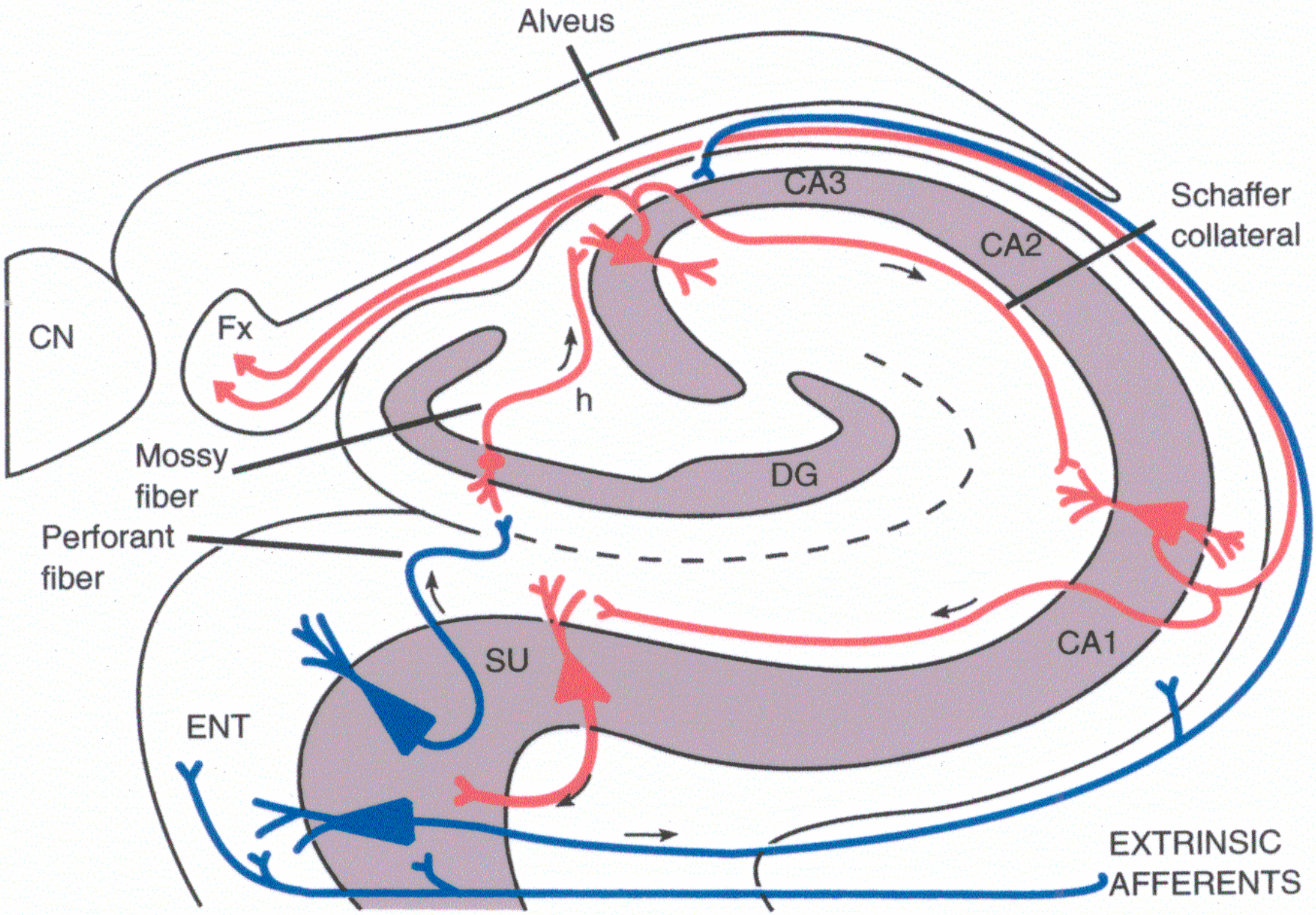
Hippocampus.

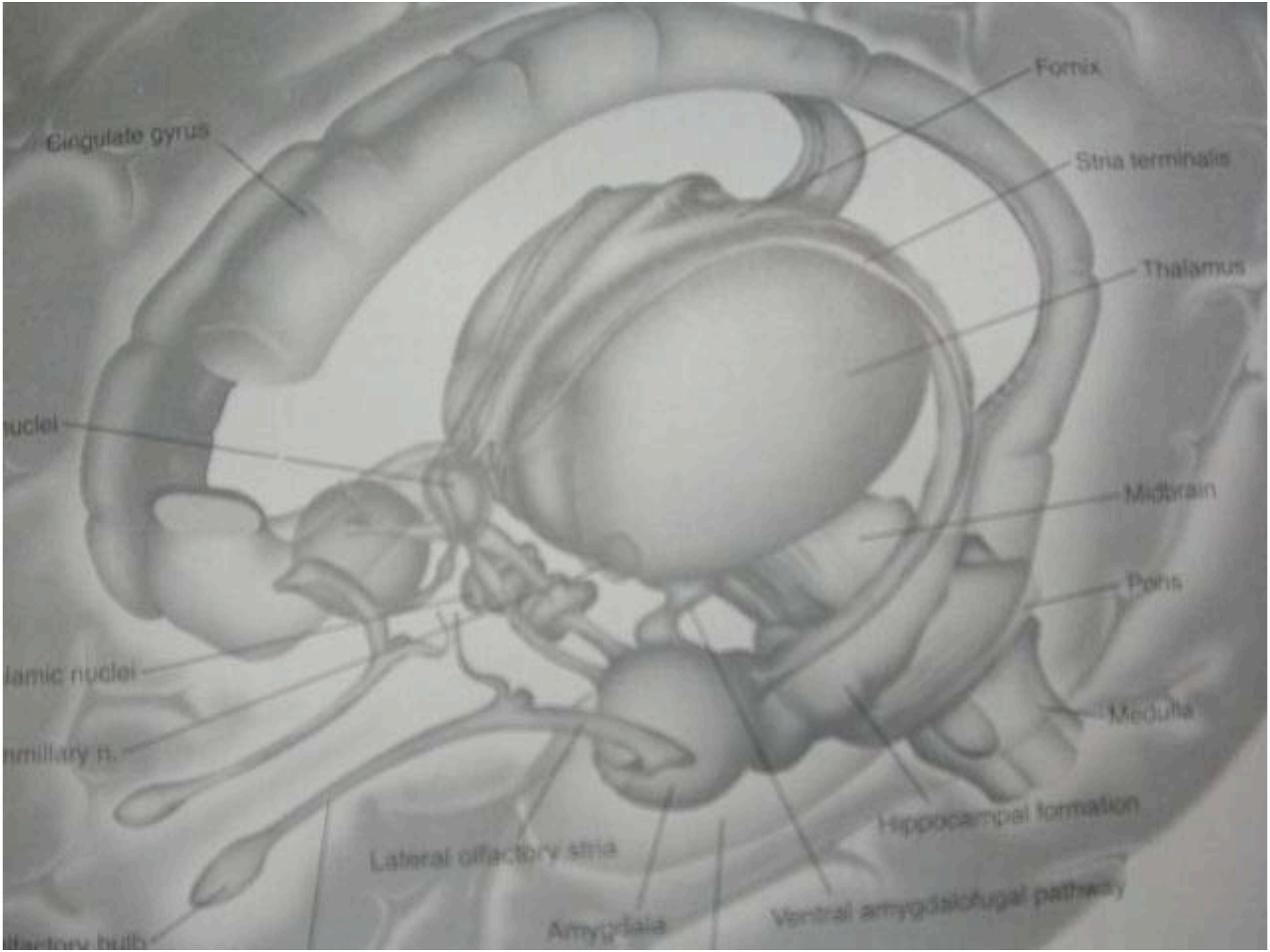
- Hippocampus, (Gr a horse+ lat; field or race-track).
- Hippocampus (Greek, Hippos+campos= Horse +a mythical sea monster) some may translate it as a caterpillar.
- Early descriptions.
  - Arantius 1587, sea horse, silk worm.
  - Duvernoy 1729, hippocampus and sea horse.
  - Winslow 1752, Ram horn.


Temporal horn
T.S vein
Stria terminalis
Tail of caudate
Choroidal fissure
Choroid plexus
Fimbria
Dentato-fimbrial sulcus
Polymorphic cell layer
Dentate gyrus
Pyramidal cell layer
Hippocampal sulcus
Molecular cell layer
Subiculum
Collateral sulcus

Hippocampal connections.

- Afferent connections.
  - Entorhinal area,(neo-cortex).
  - Amygdala
  - Septal area.
  - Contralateral hippocampus.
  - Reticular formation of the brain stem.


Alveus
CA3
Schaffer
collateral
CA2
CN
Fx
h
Mossy
fiber
DG
Perforant
fiber
SU
CA1
ENT
EXTRINSIC
AFFERENTS


Fornix
Cingulate gyrus
Stria terminalis
Thalamus
uclei
Midbrain
Pons
lamic nuclei
Medulla
millary n.
Hippocampal formation
Lateral olfactory stria
Ventral amygdalofugal pathway
Amygdala

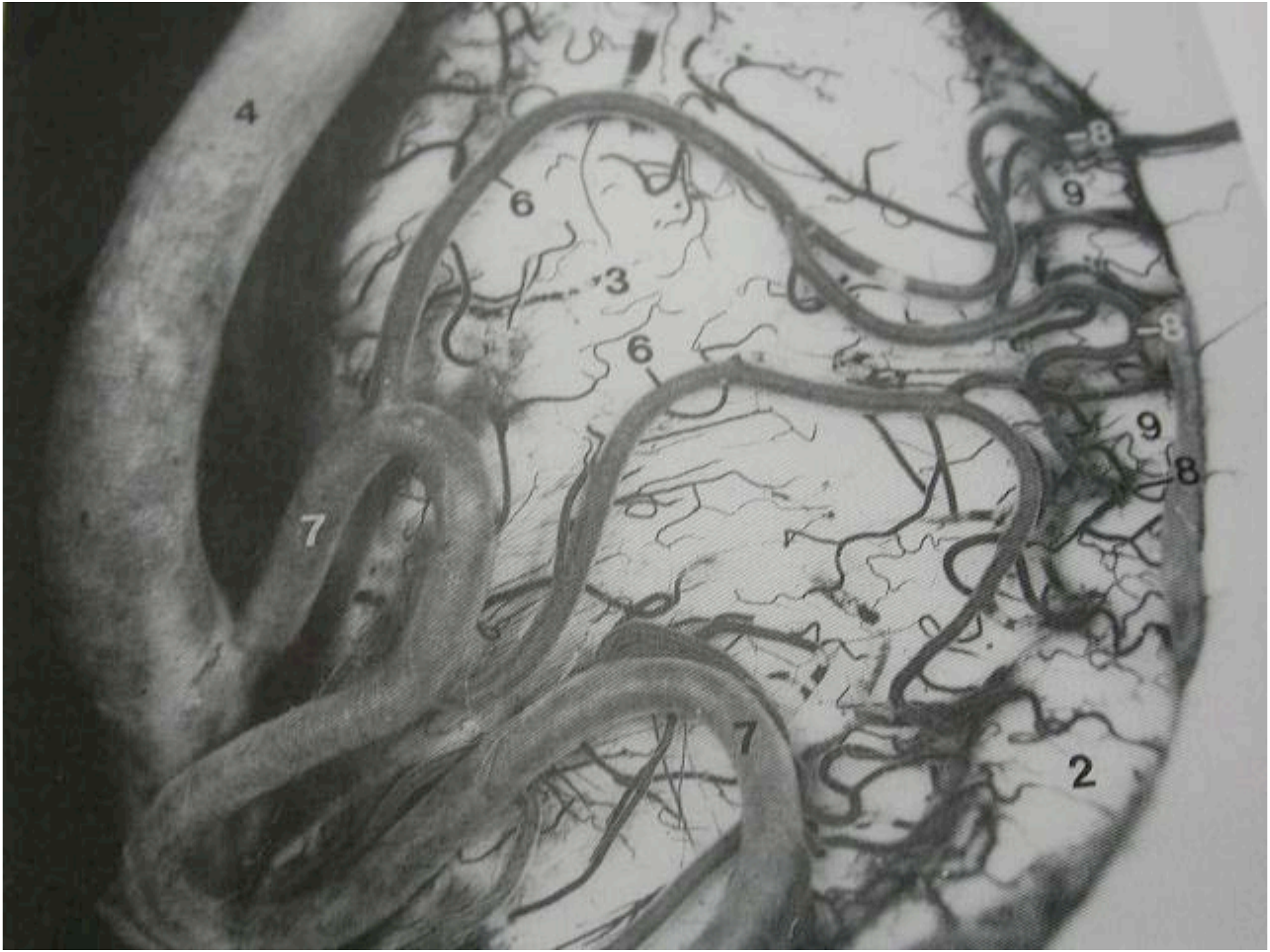
- Efferent:
  - Fornix, (one million fibres).

Hippocampal formation.

- Hippocampus
- Dentate gyrus
- Parahippocampal gyrus, (subiculum).

Dentate gyrus.

- Continued growth of the cortical tissue of the hippocampus may be responsible for the development of the dentate gyrus.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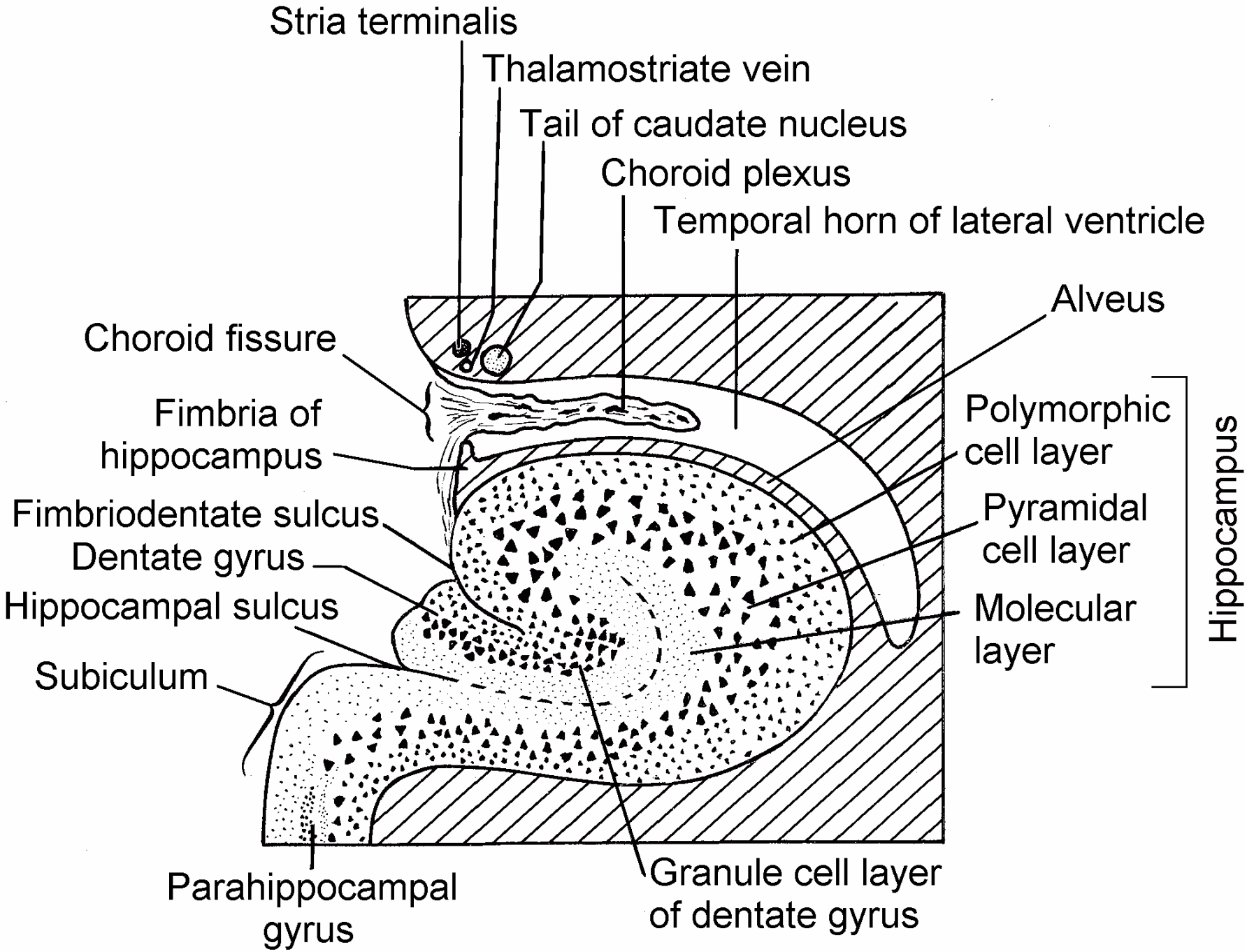
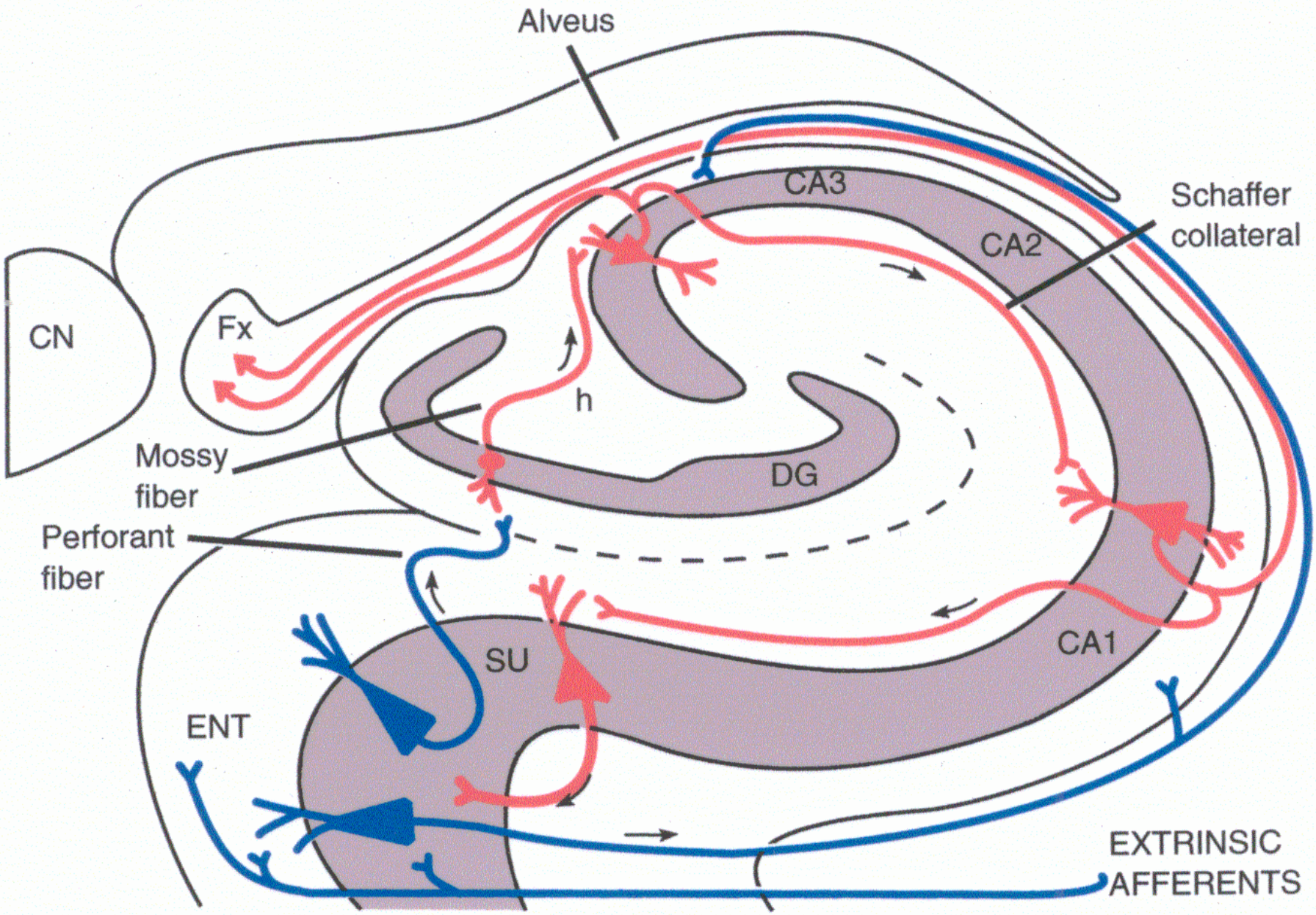
Alveus

- Alveus (L), canal or trough
- Covers the intra-ventricular surface of the hippocampus, just underneath a layer of ependyma
- Continue medially as the fimbria, which continue as the fornix

Alveus

- It contains both the afferent and efferent projections from and to the septal nuclei.


Stria terminalis
Thalamostriate vein
Tail of caudate nucleus
Choroid plexus
Temporal horn of lateral ventricle
Alveus
Choroid fissure
Fimbria of hippocampus
Polymorphic cell layer
Pyramidal cell layer
Molecular layer
Hippocampus
Fimbriodentate sulcus
Dentate gyrus
Hippocampal sulcus
Subiculum
Parahippocampal gyrus
Granule cell layer of dentate gyrus


Alveus
CA3
Schaffer
collateral
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Mossy
fiber
DG
Perforant
fiber
SU
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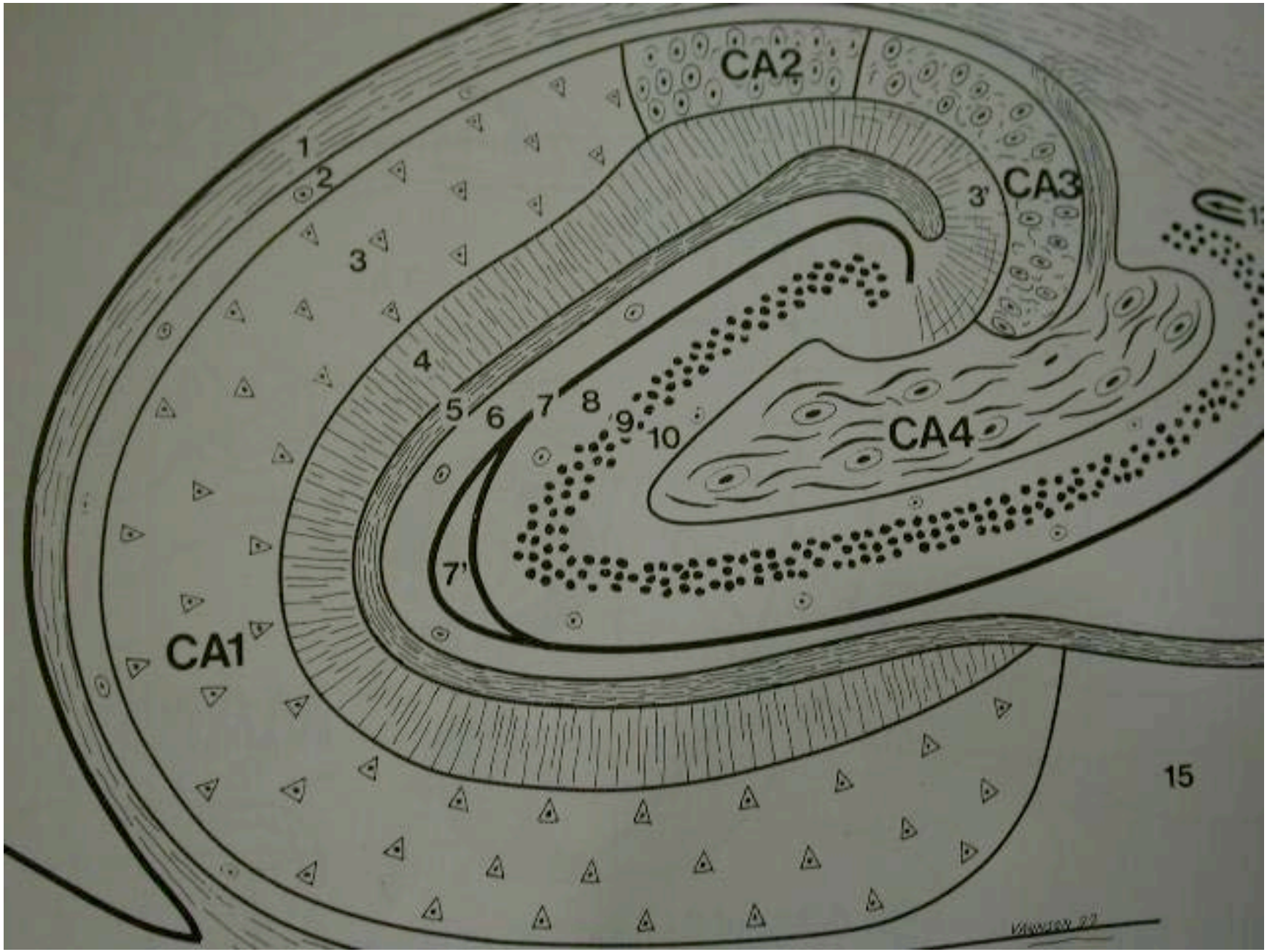
ENT
EXTRINSIC
AFFERENTS


CA2
CA3
CA4
CA1
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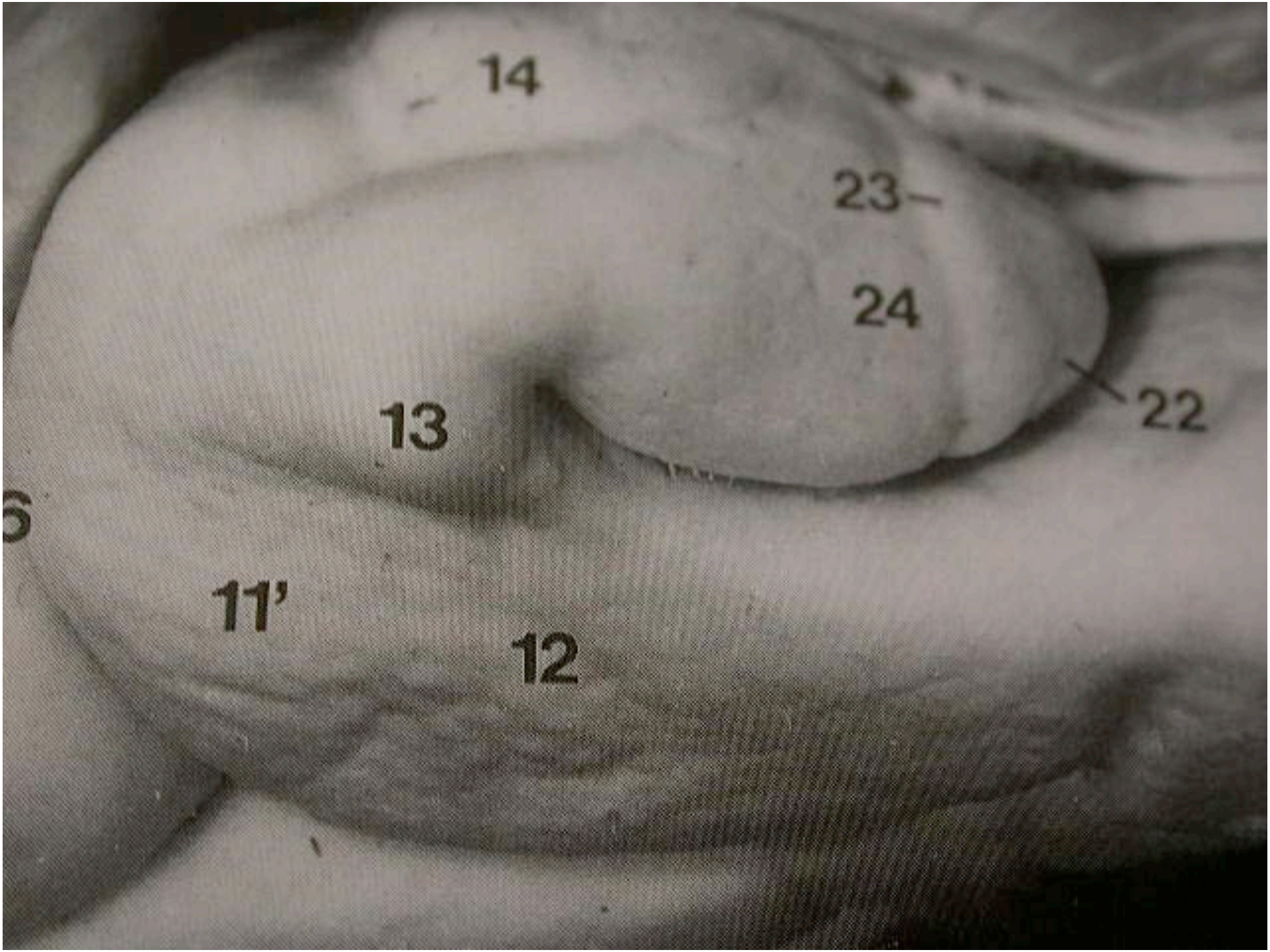
Entorrhinal area.

The anterior area of the parphippocampal gyrus medial to the rhinal sulcus.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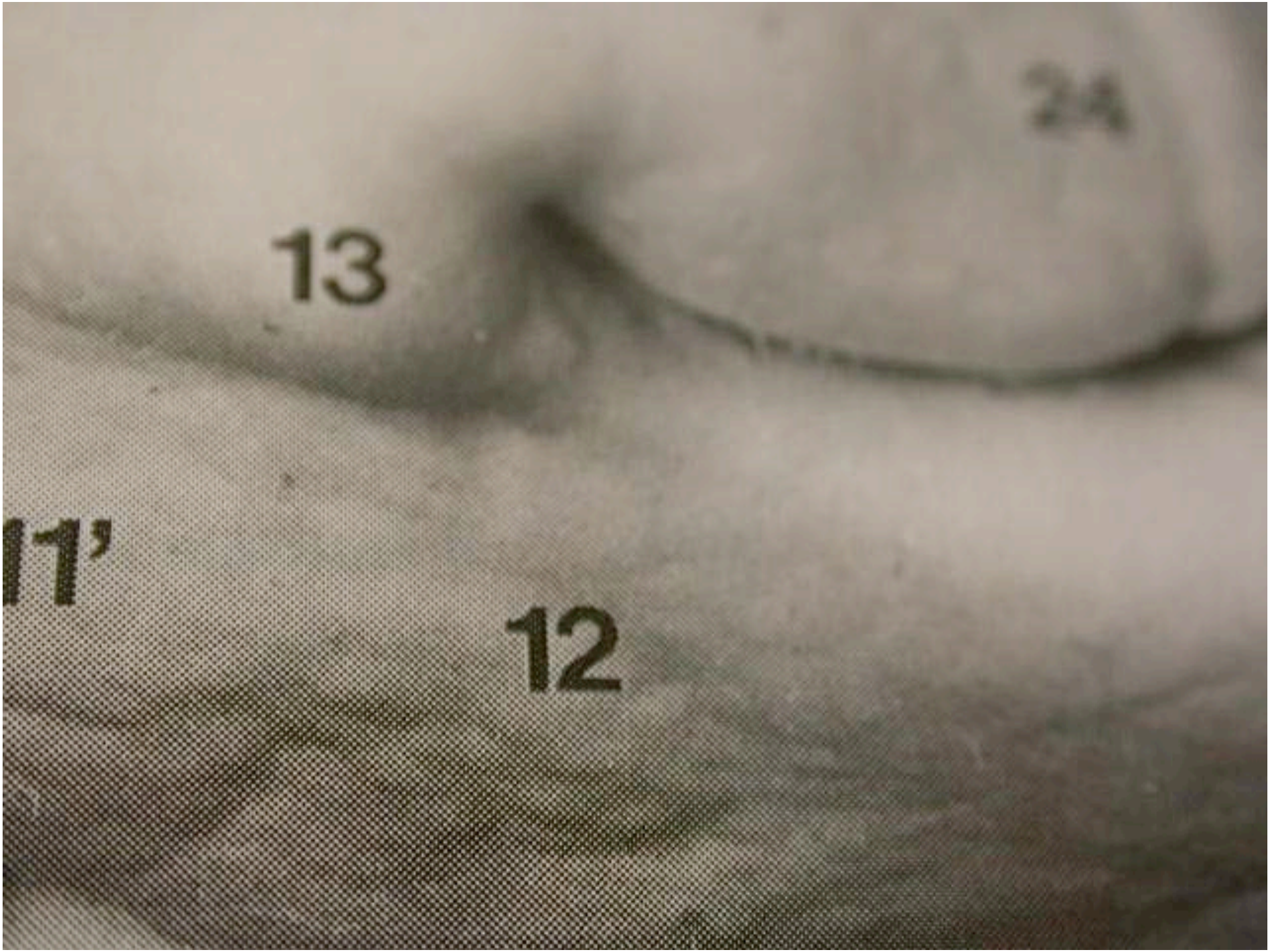
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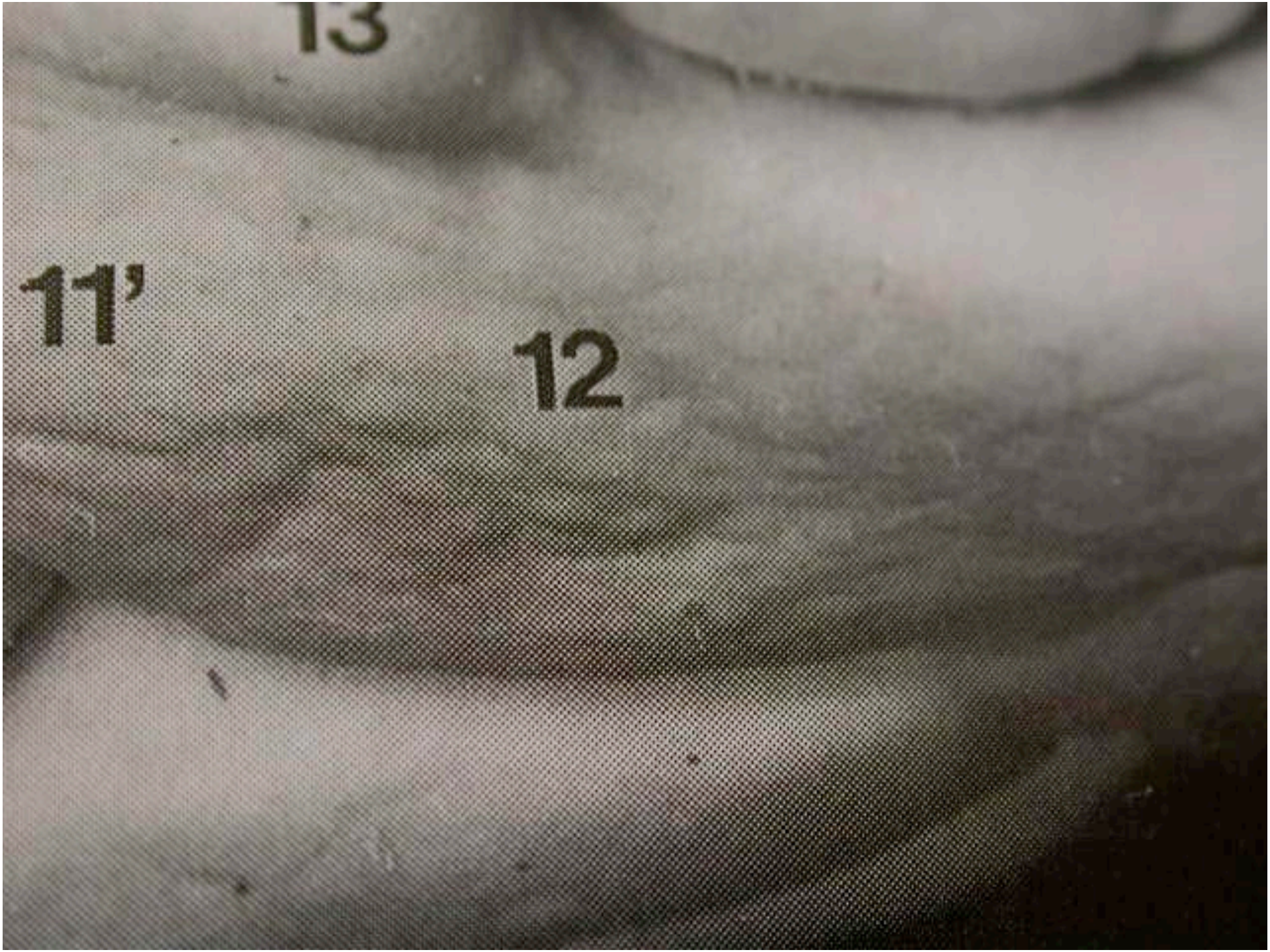
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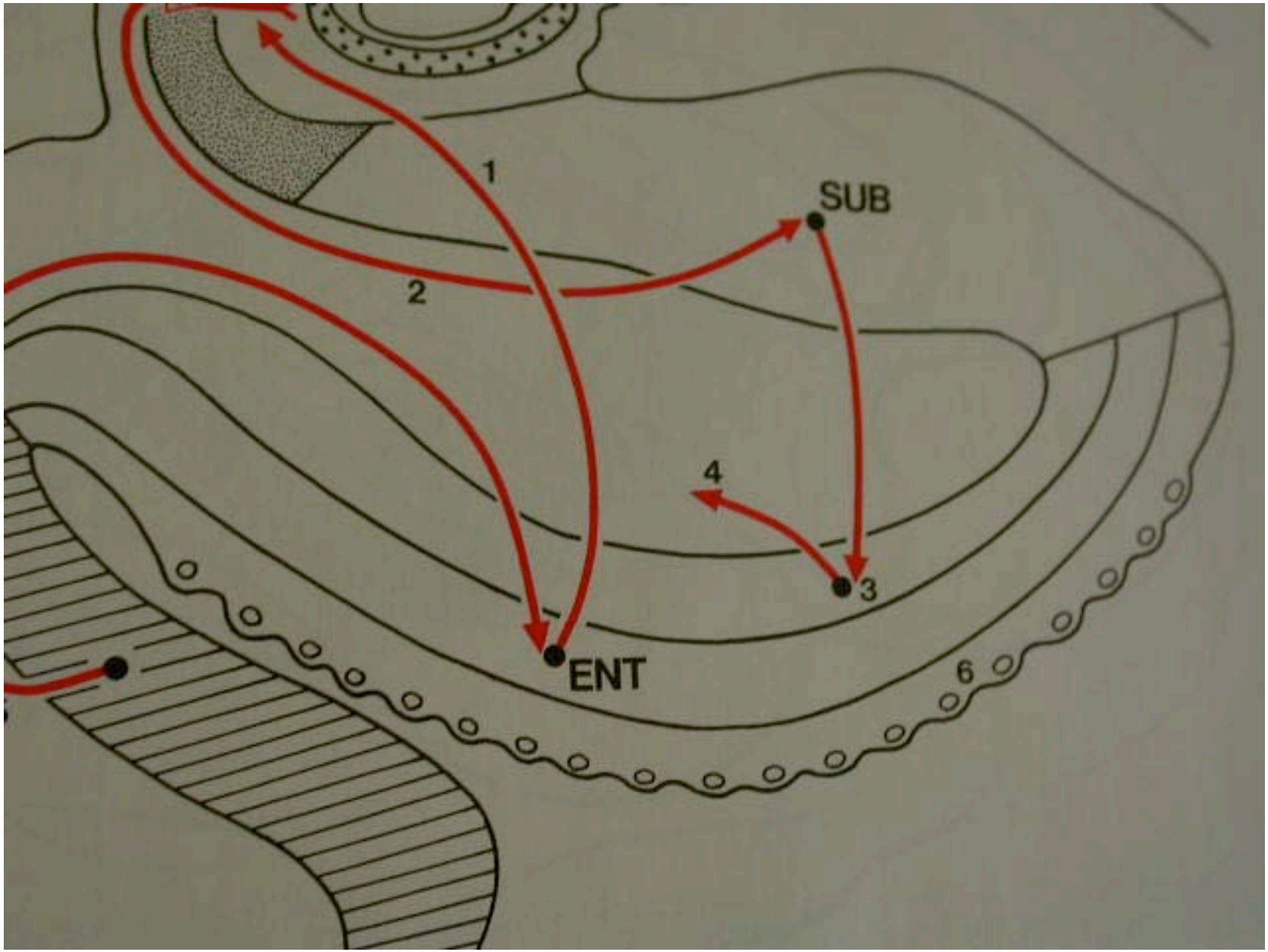
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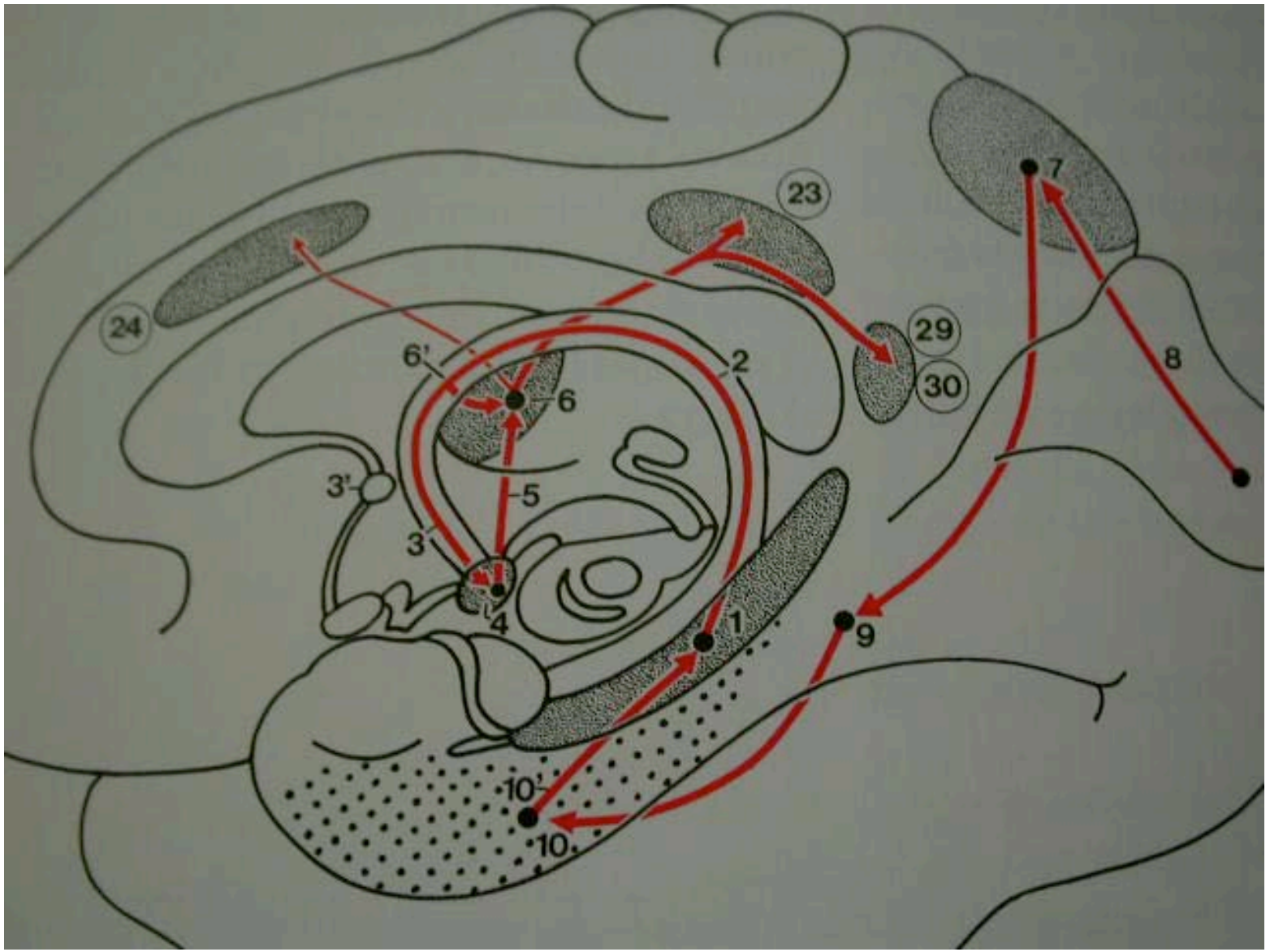
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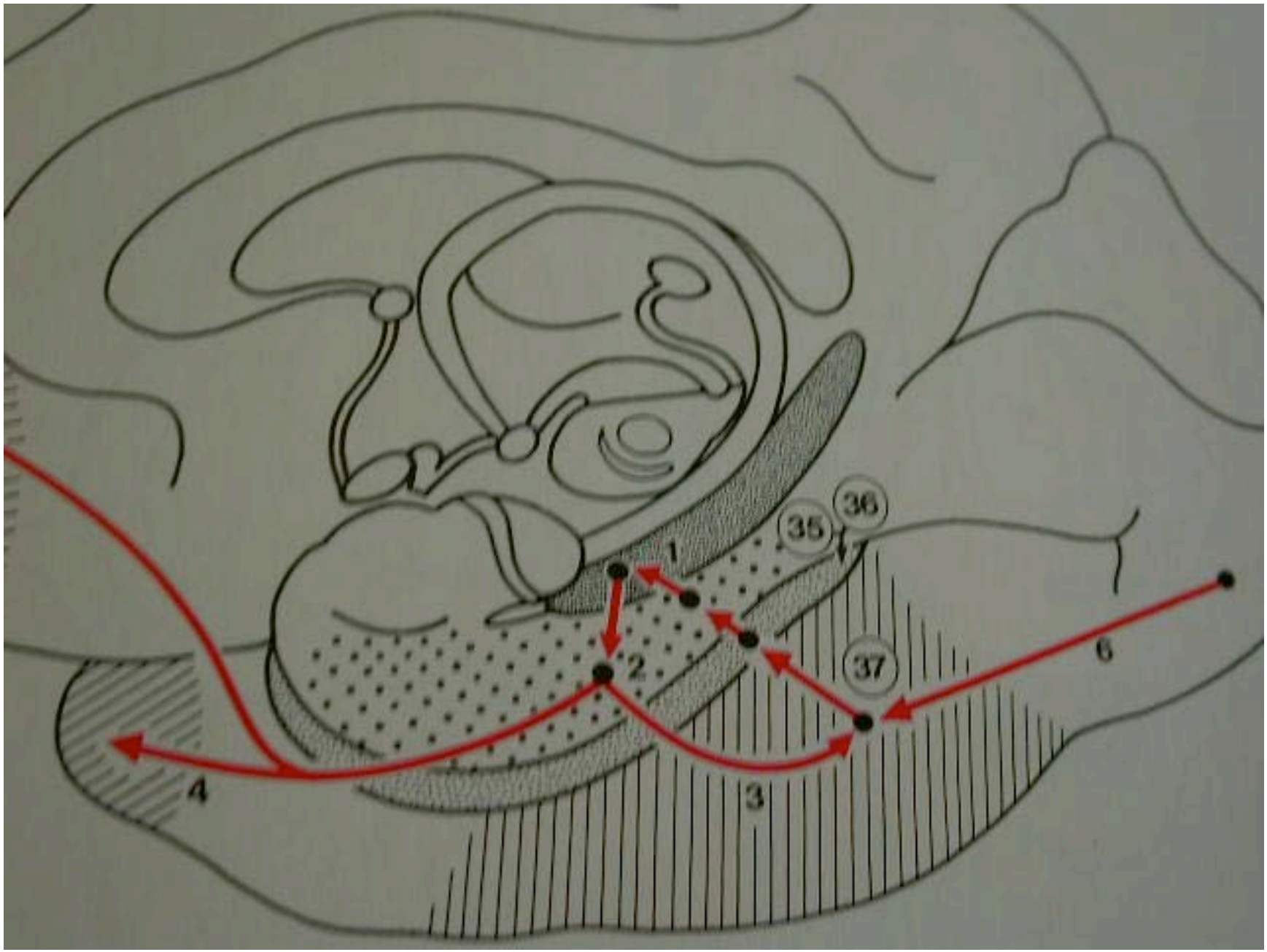
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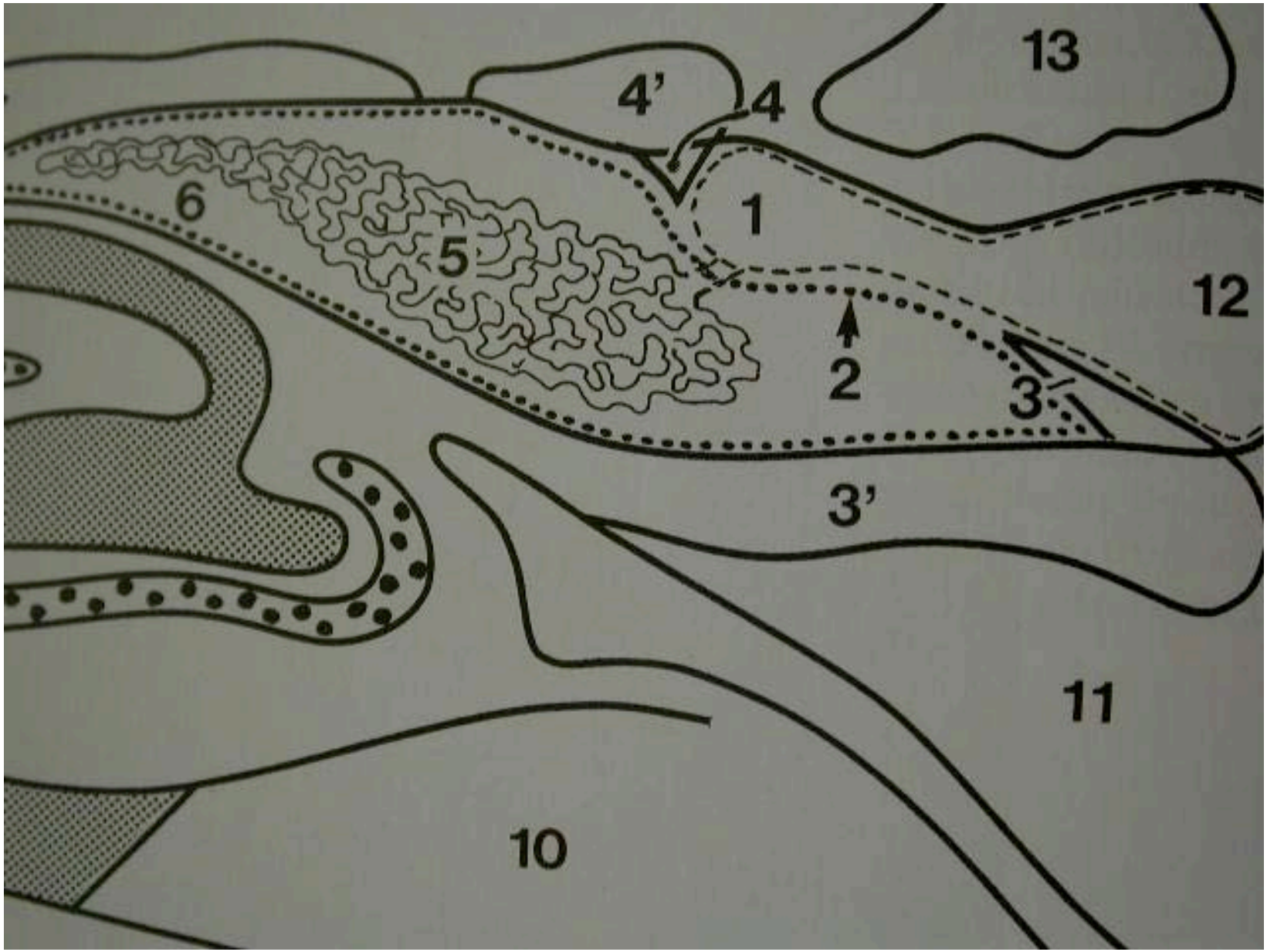
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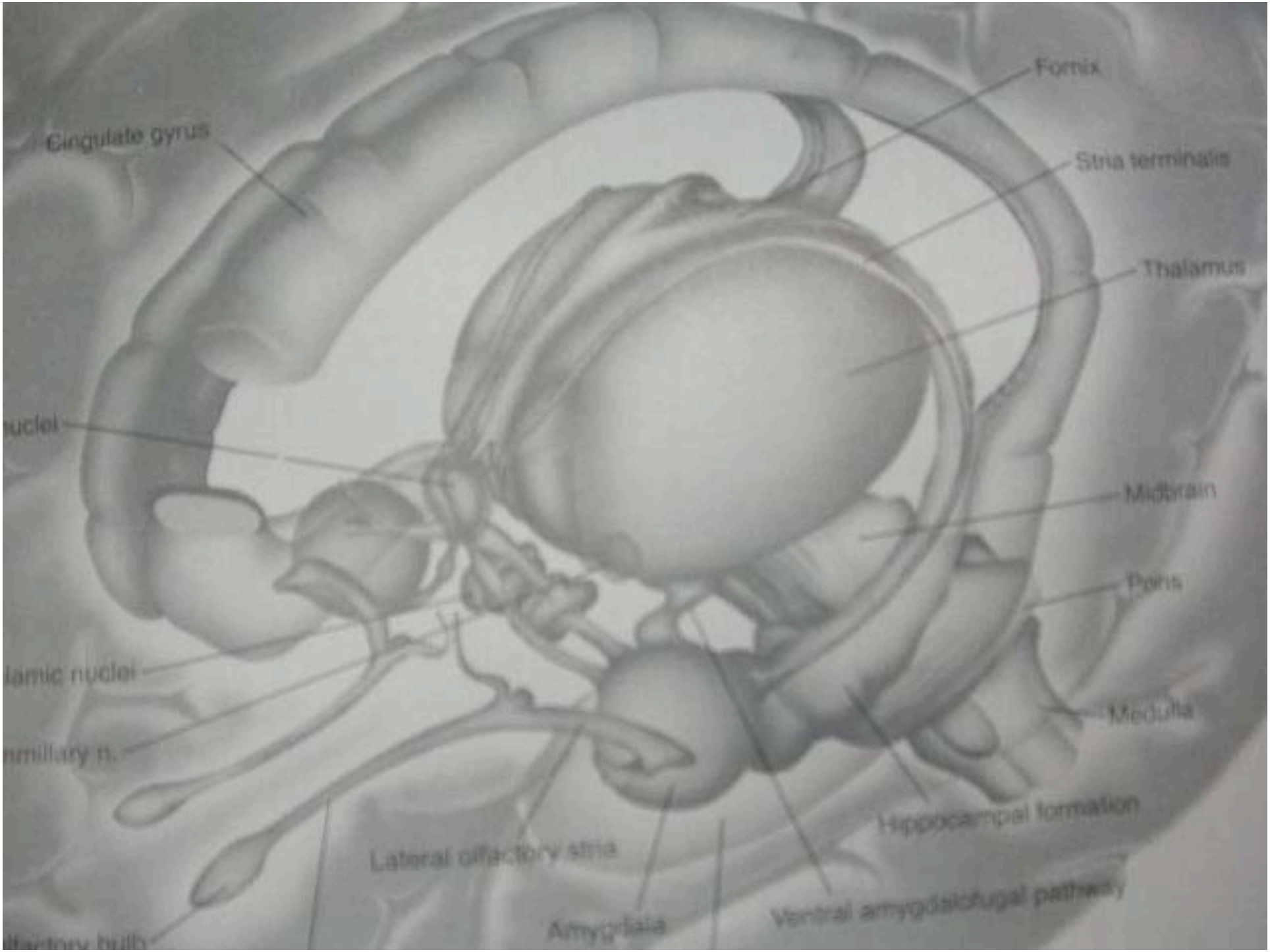
Fornix
Cingulate gyrus
Stria terminalis
Thalamus
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Midbrain
Pons
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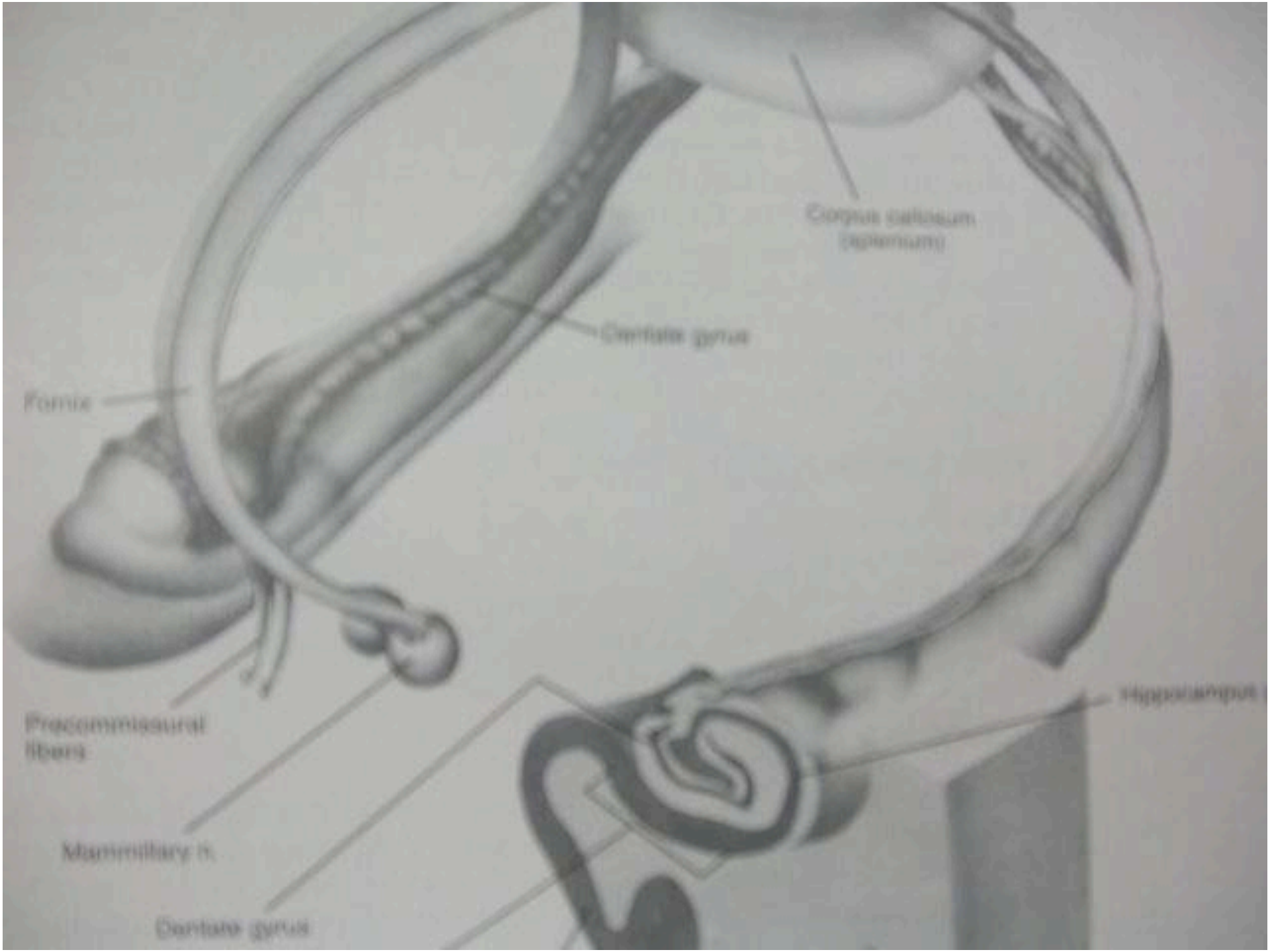
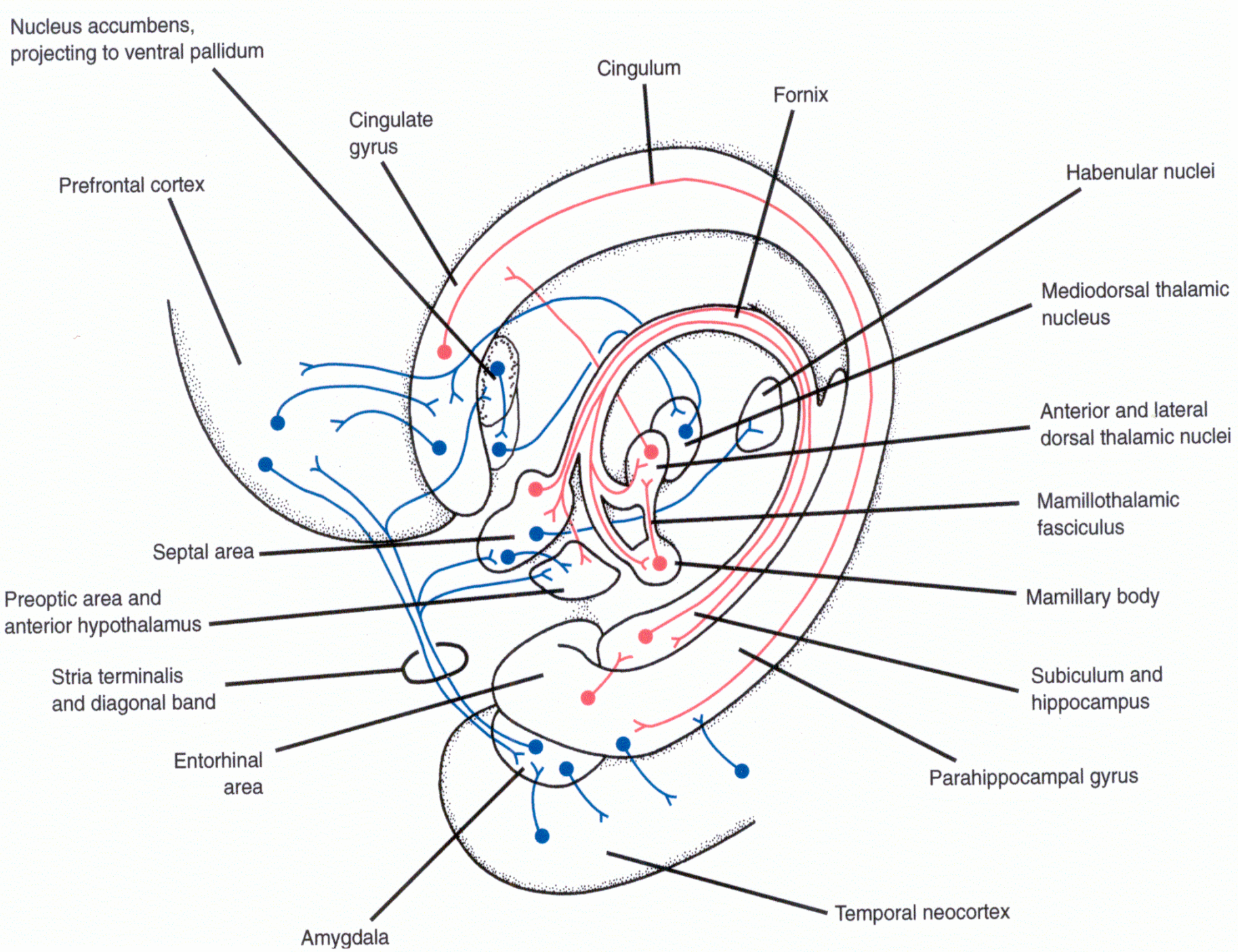
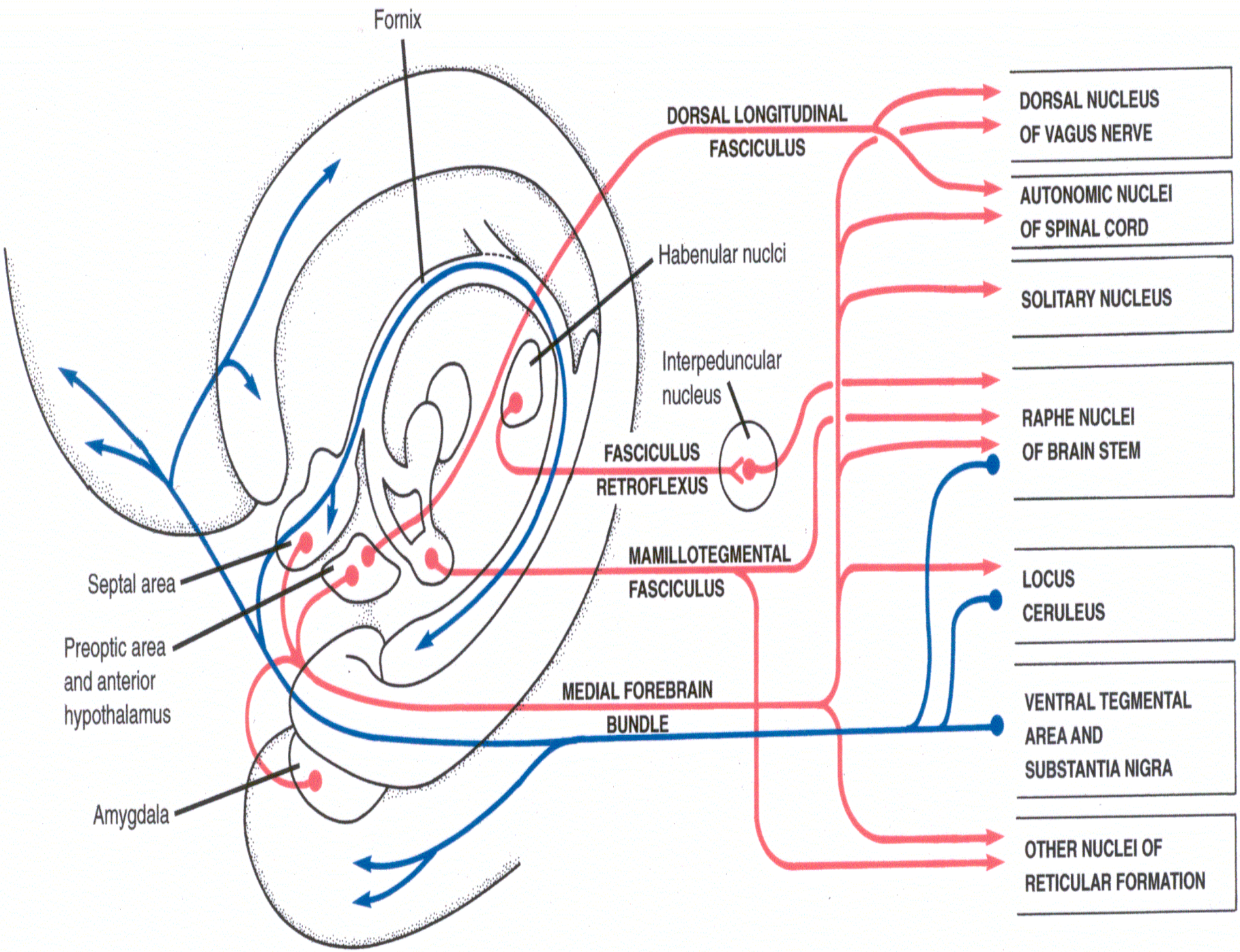
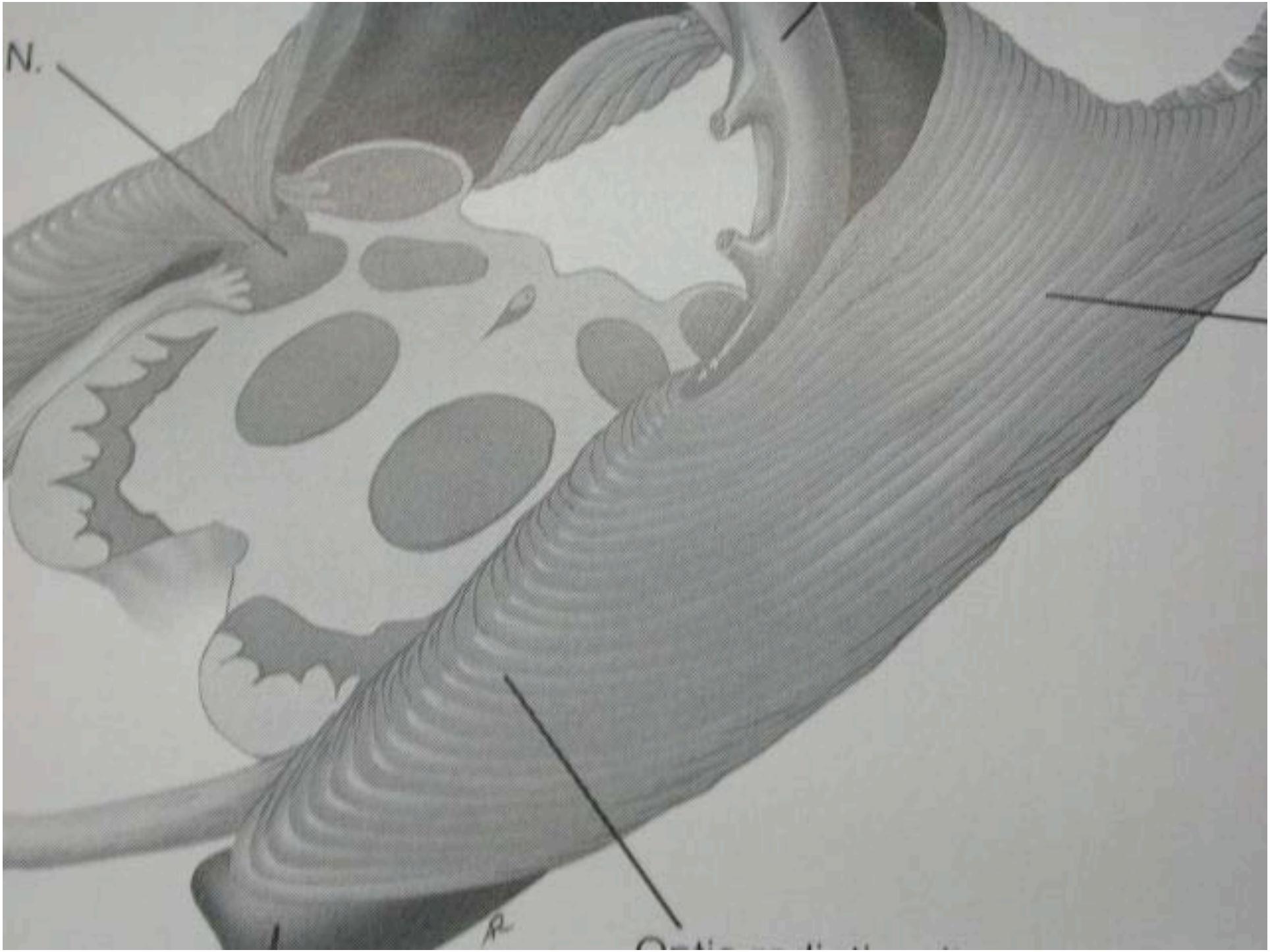
Medulla
millary n.
Hippocampal formation
Lateral olfactory stria
Ventral amygdalofugal pathway
Amygdala

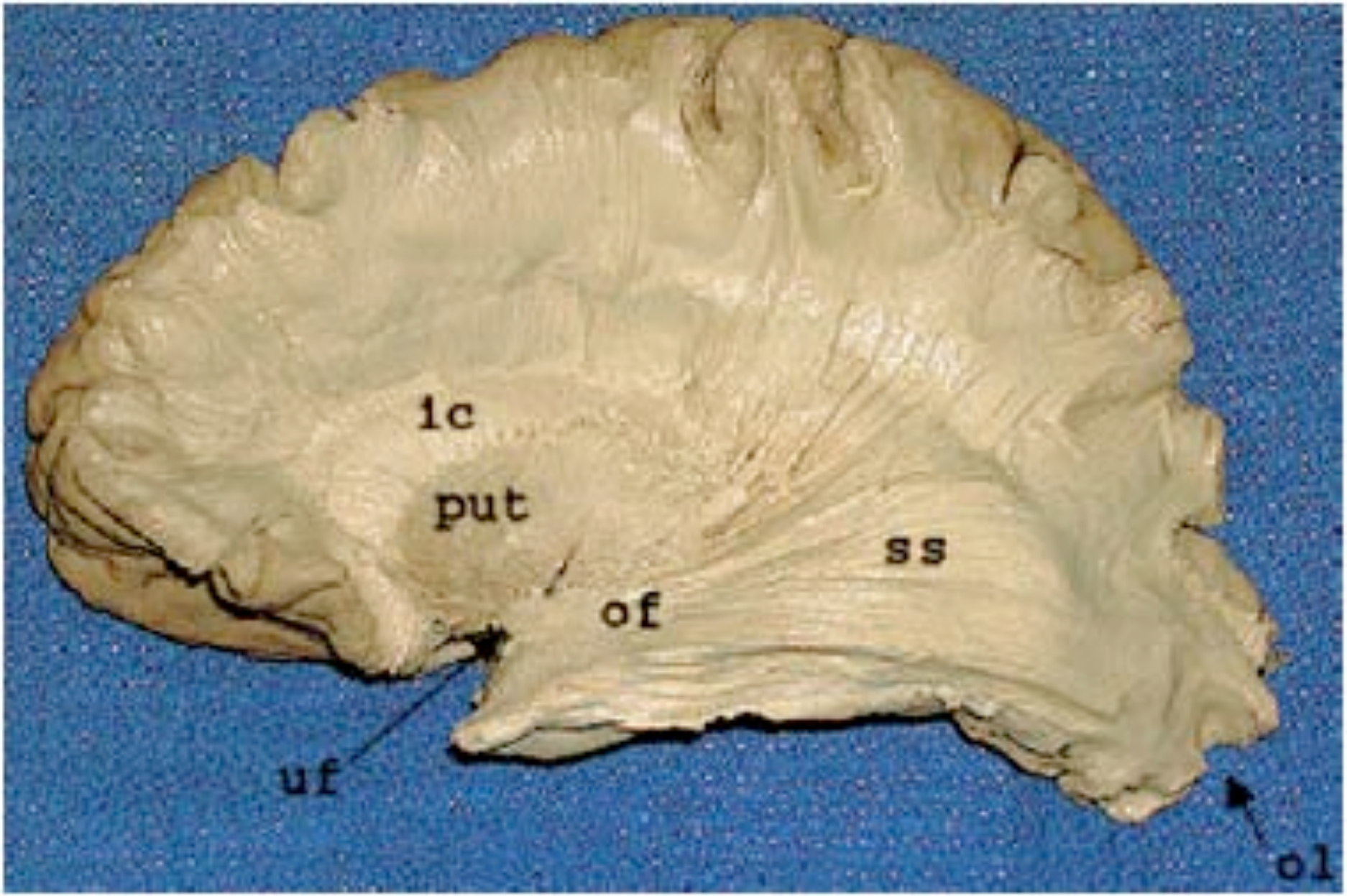

Corpus callosum (splenium)
Cingulate gyrus
Fornix
Precommissural fibers
Mammillary n.
Dentate gyrus

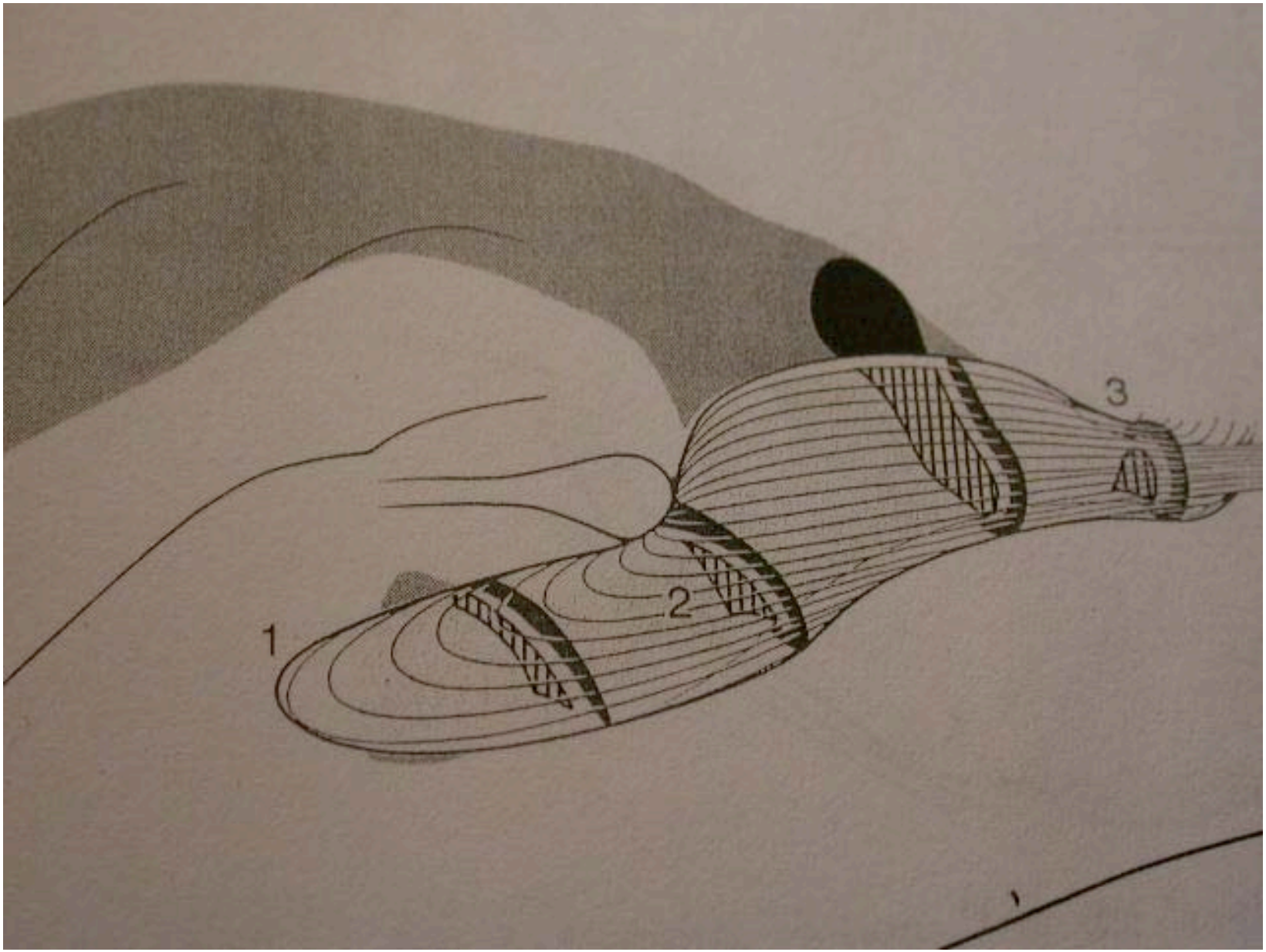

Nucleus accumbens, projecting to ventral pallidum
Cingulum
Fornix
Cingulate gyrus
Prefrontal cortex
Habenular nuclei
Mediodorsal thalamic nucleus
Anterior and lateral dorsal thalamic nuclei
Mamillothalamic fasciculus
Septal area
Mamillary body
Preoptic area and anterior hypothalamus
Stria terminalis and diagonal band
Subiculum and hippocampus
Entorhinal area
Parahippocampal gyrus
Amygdala
Temporal neocortex

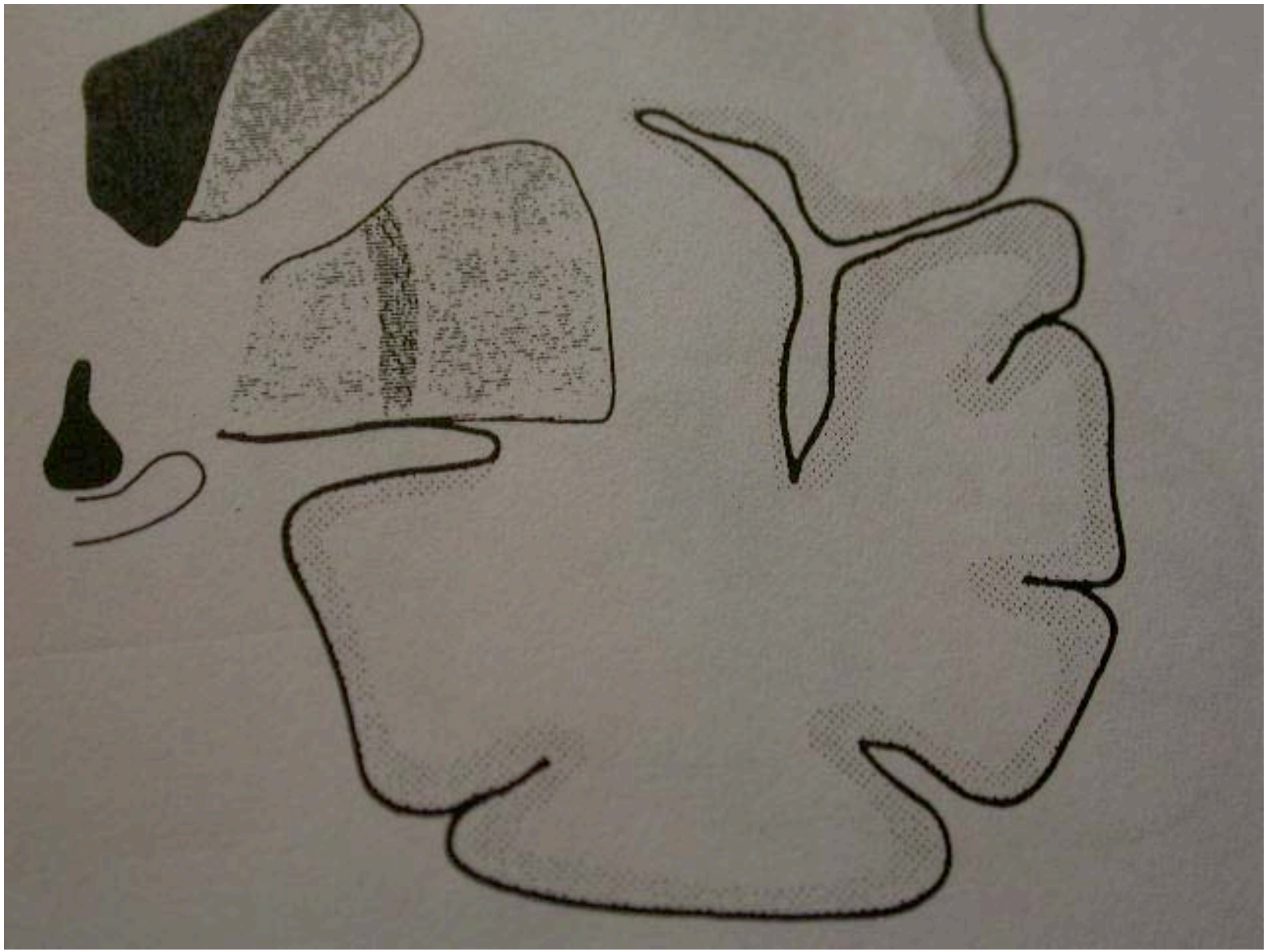

Fornix
Habenular nuclci
Interpeduncular nucleus
FASCICULUS RETROFLEXUS
DORSAL LONGITUDINAL FASCICULUS
MAMILLOTEGMENTAL FASCICULUS
MEDIAL FOREBRAIN BUNDLE
Septal area
Preoptic area and anterior hypothalamus
Amygdala
DORSAL NUCLEUS OF VAGUS NERVE
AUTONOMIC NUCLEI OF SPINAL CORD
SOLITARY NUCLEUS
RAPHE NUCLEI OF BRAIN STEM
LOCUS CERULEUS
VENTRAL TEGMENTAL AREA AND SUBSTANTIA NIGRA
OTHER NUCLEI OF RETICULAR FORMATION

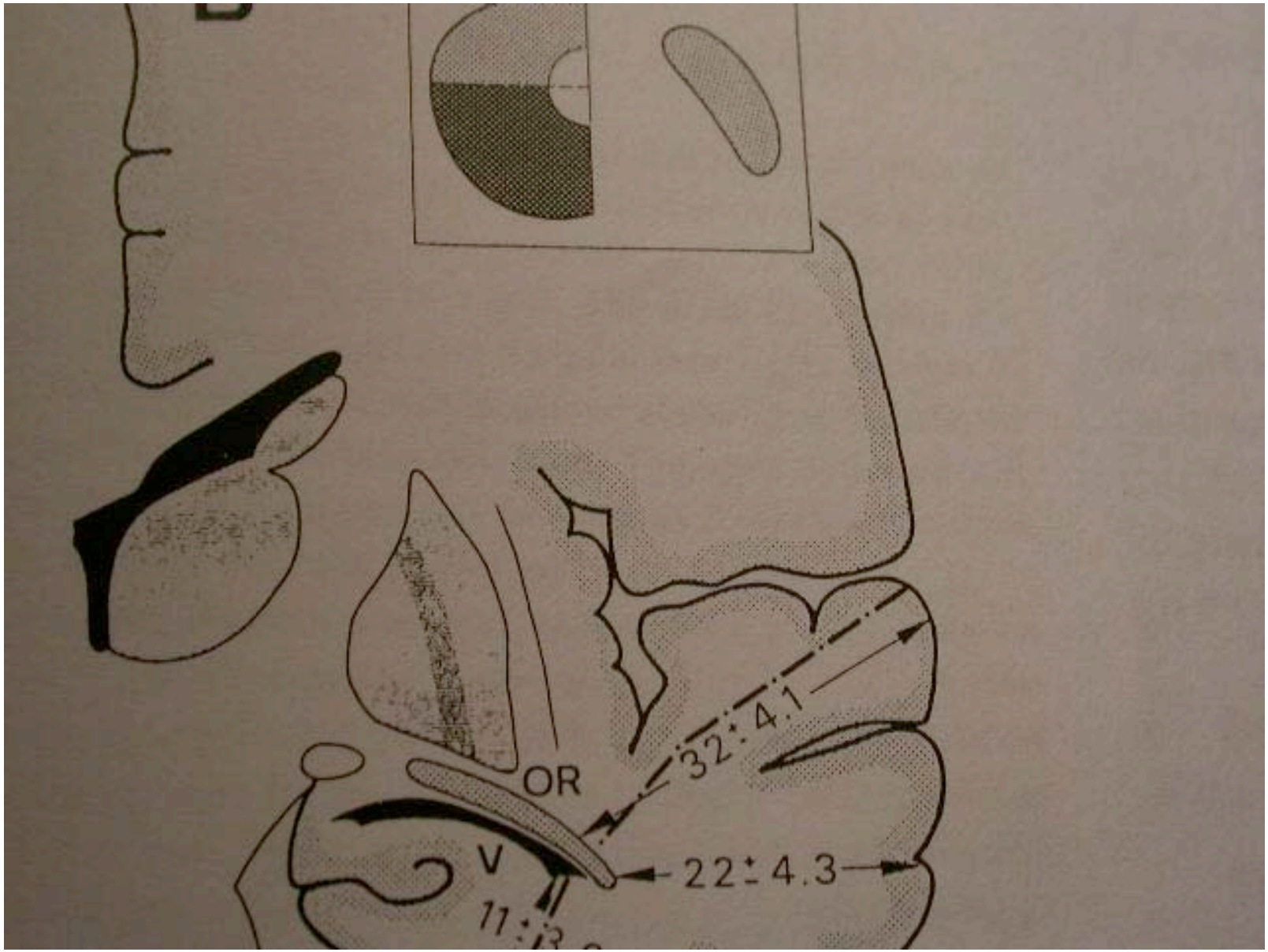
Optic radiation.

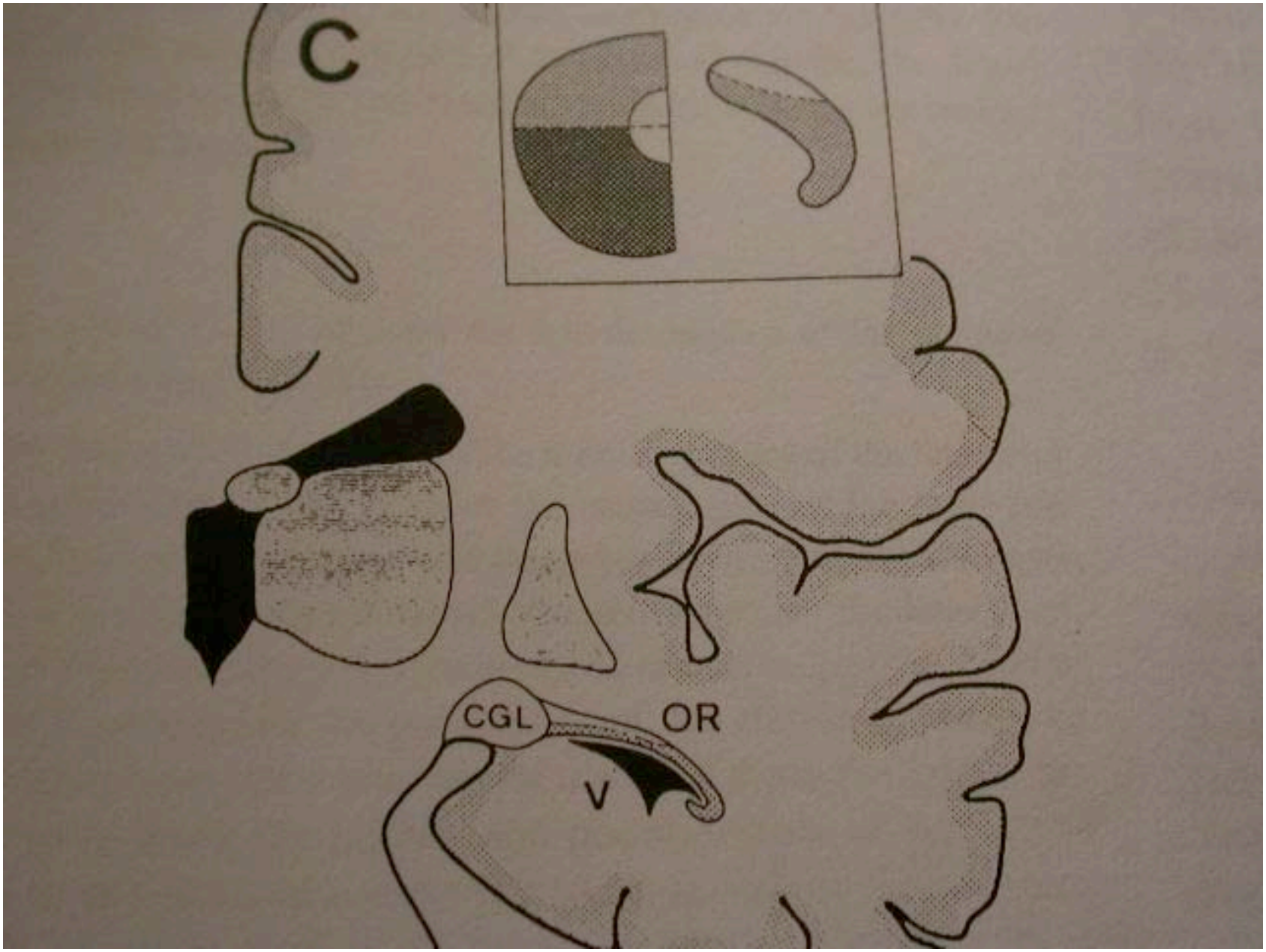

N.

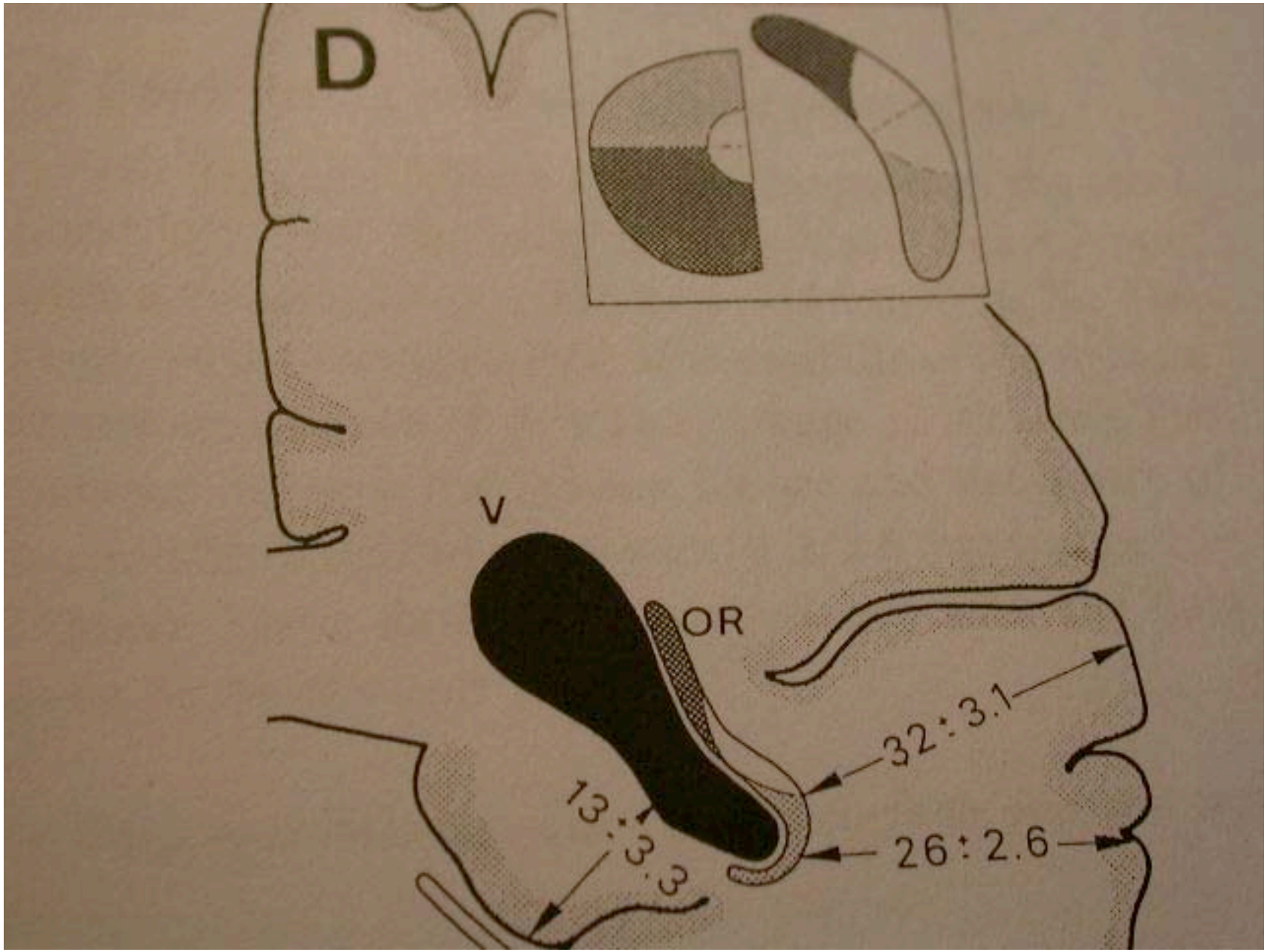

lc
put
ss
of
uf
ol

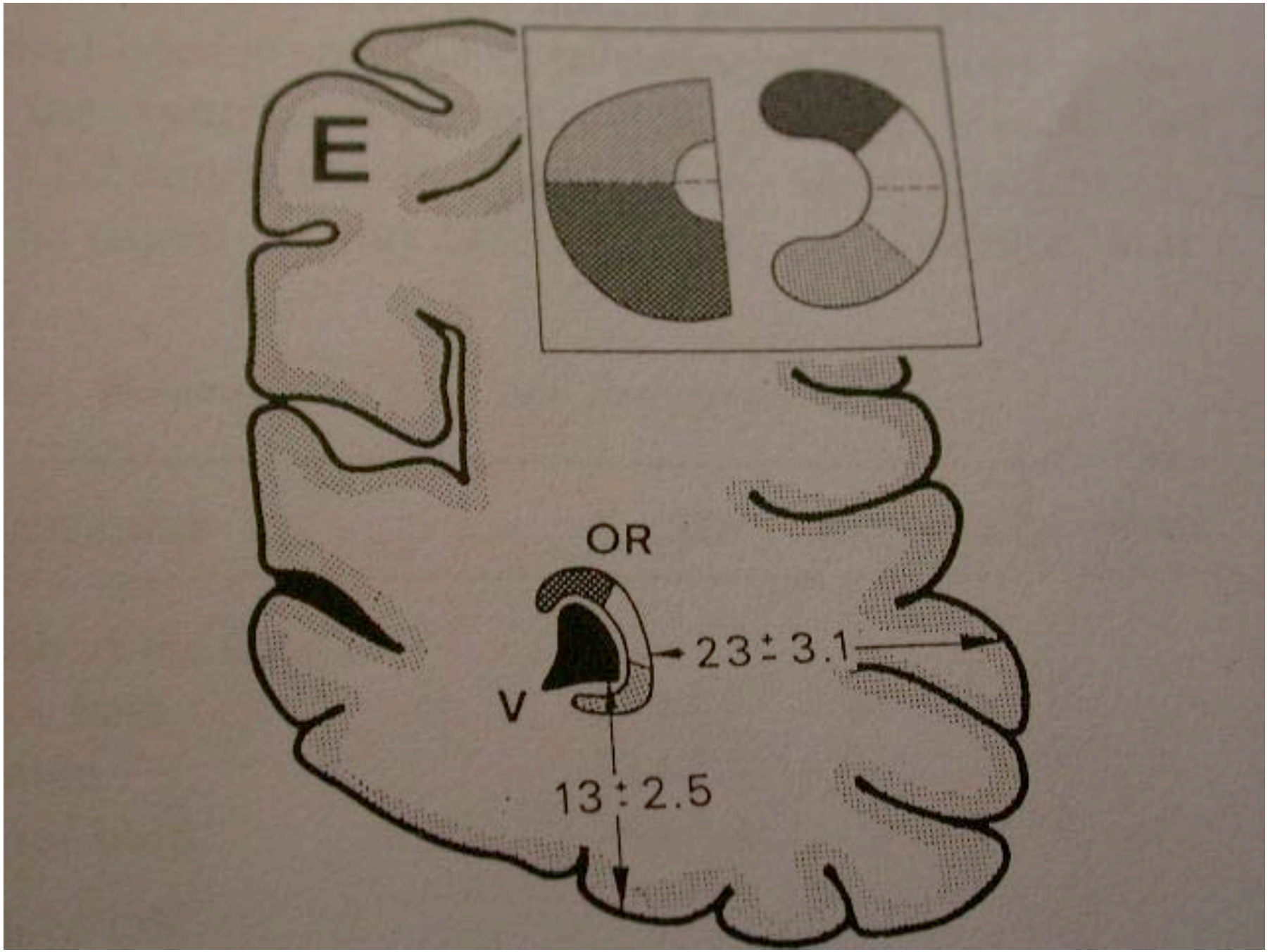

1
2
3

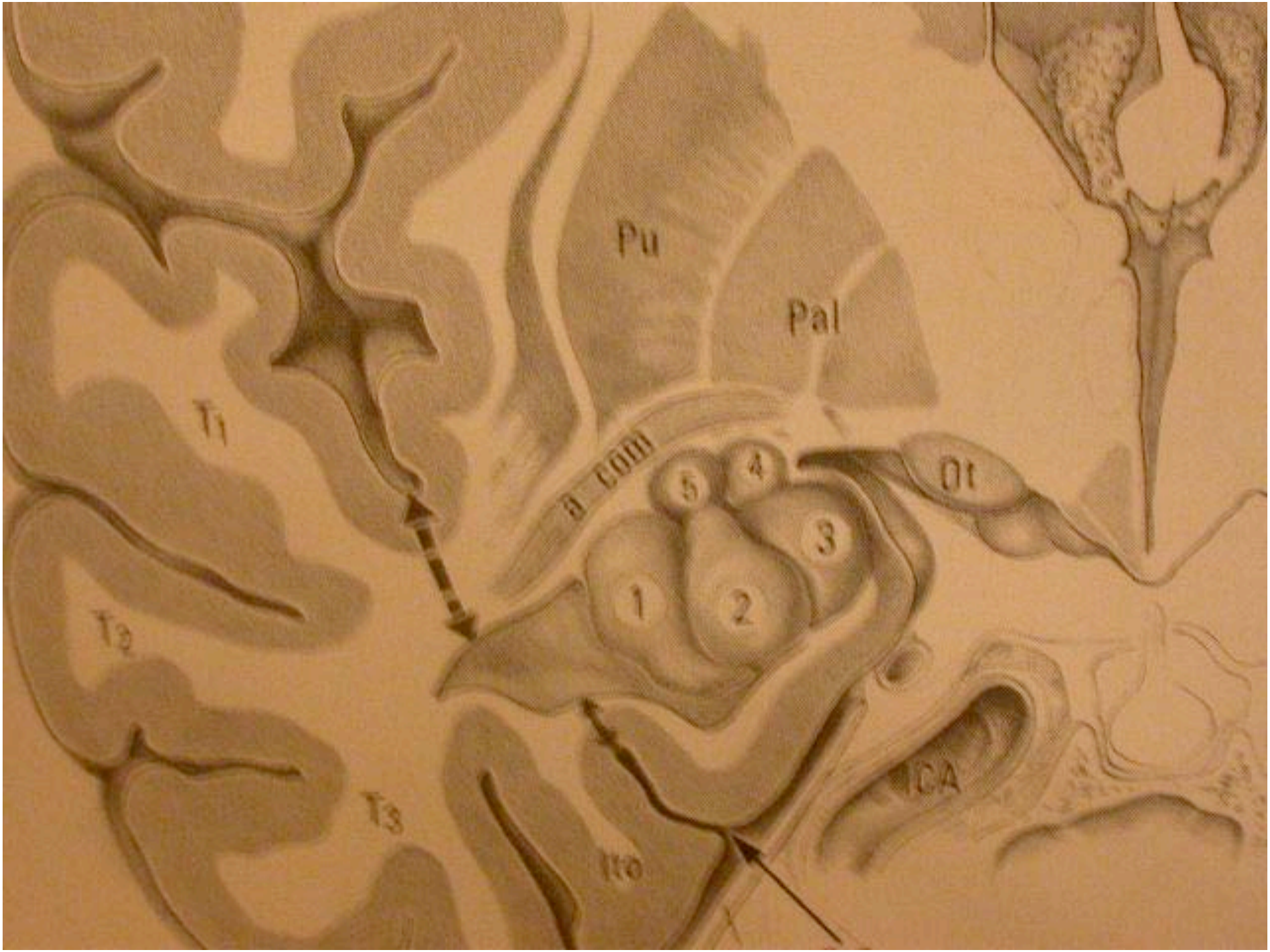


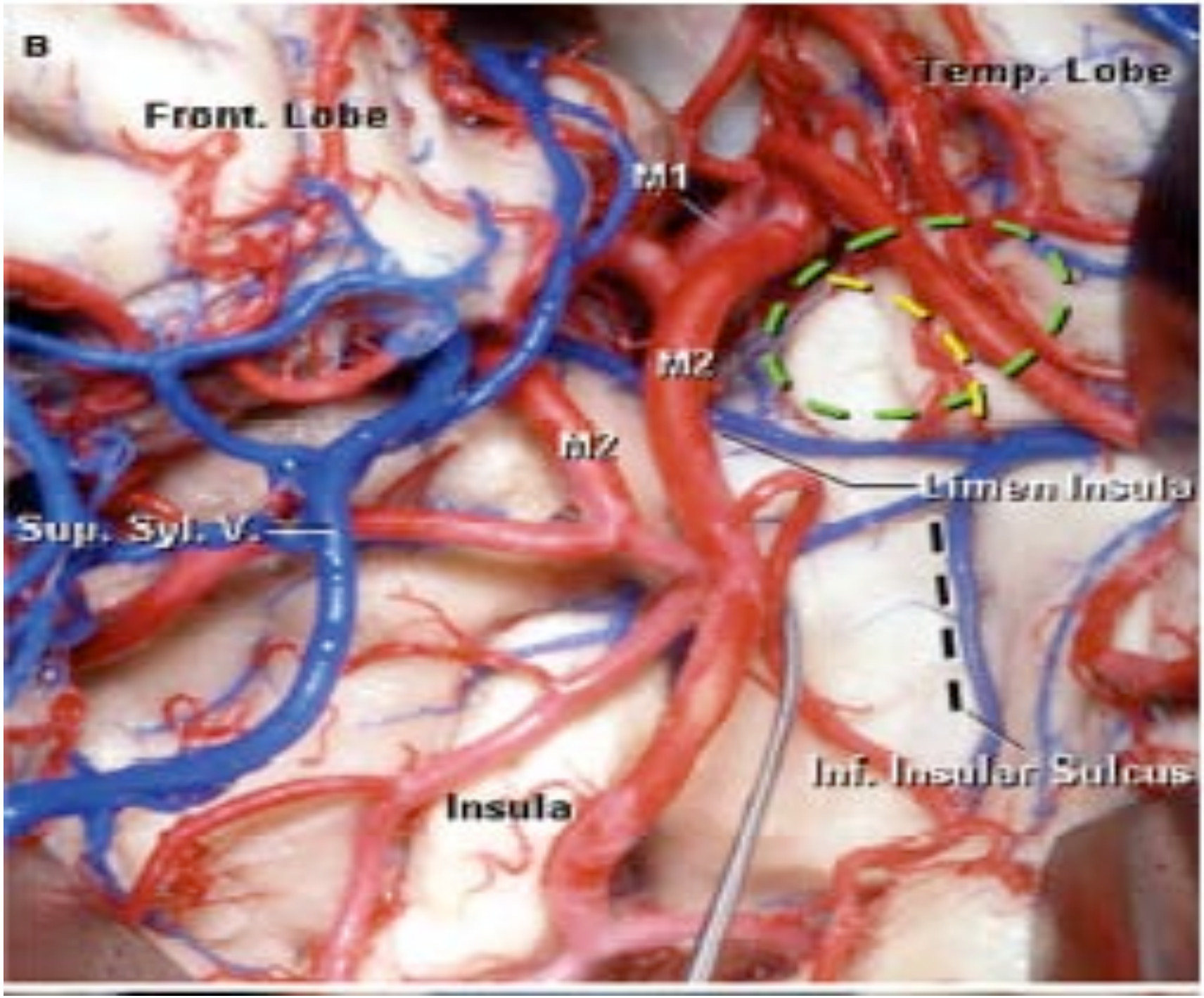

OR
32±4.1
22±4.3
V
11±3

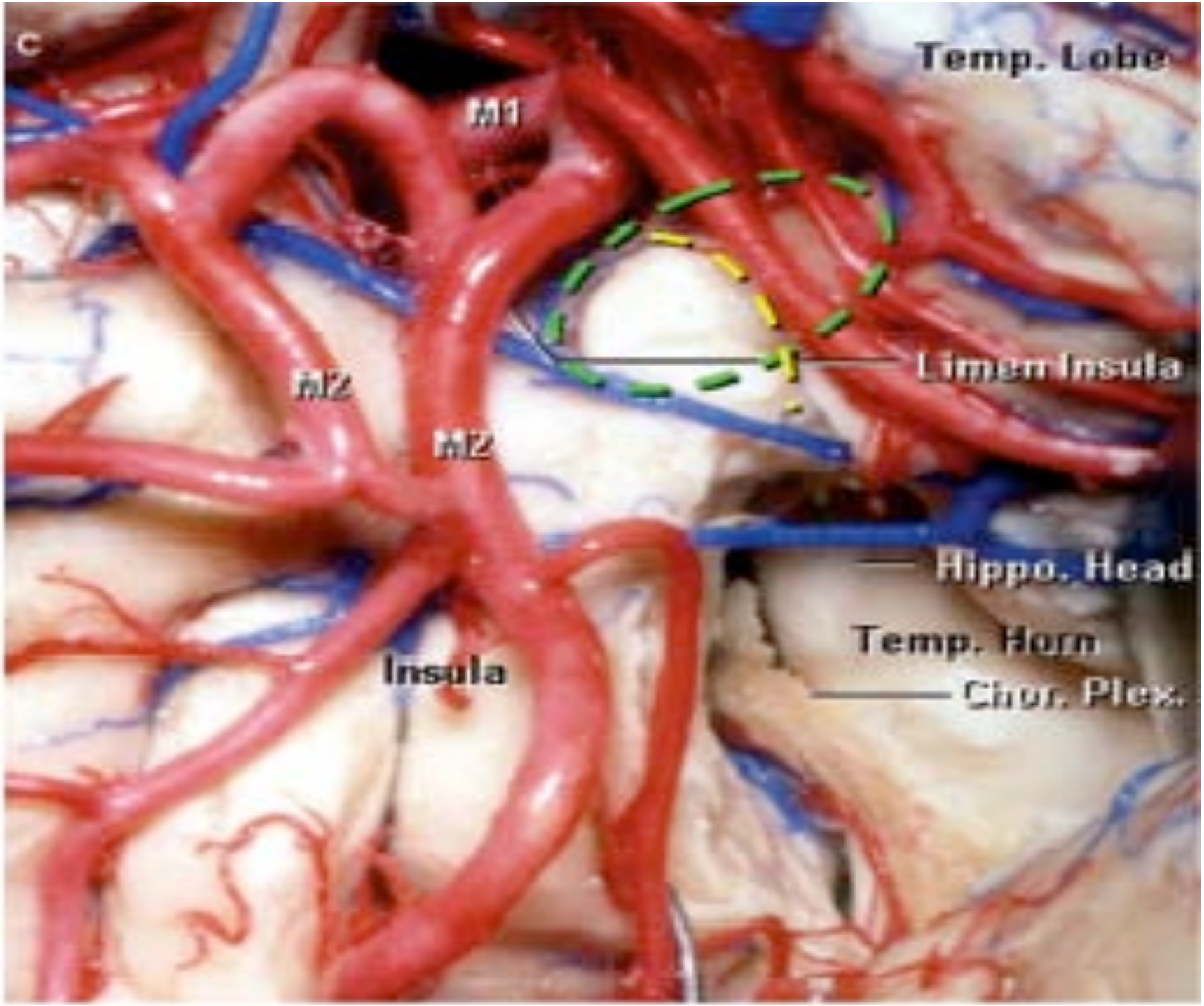

C
CGL
OR
V

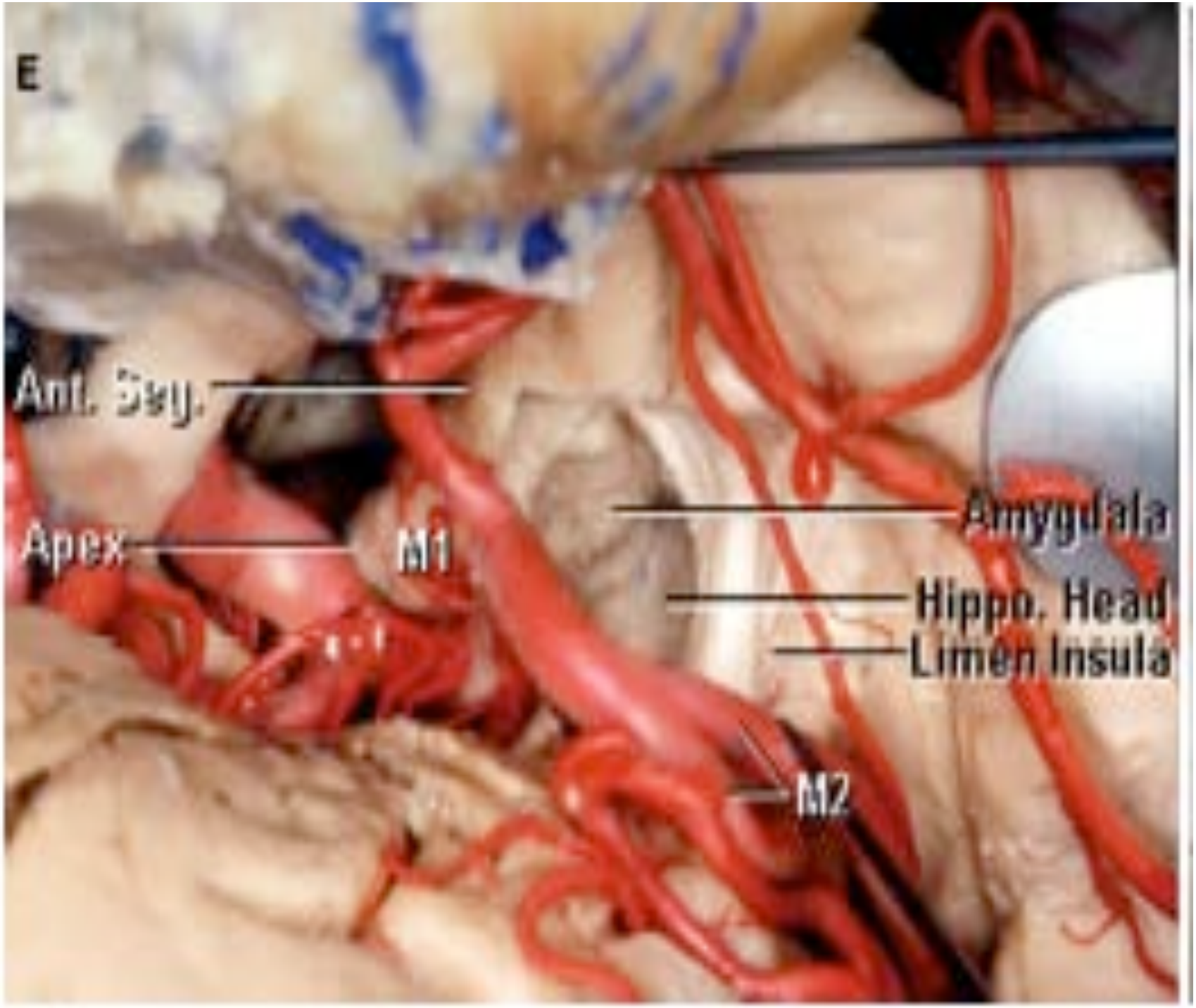

D
V
OR
32:3.1
13:3.3
26:2.6

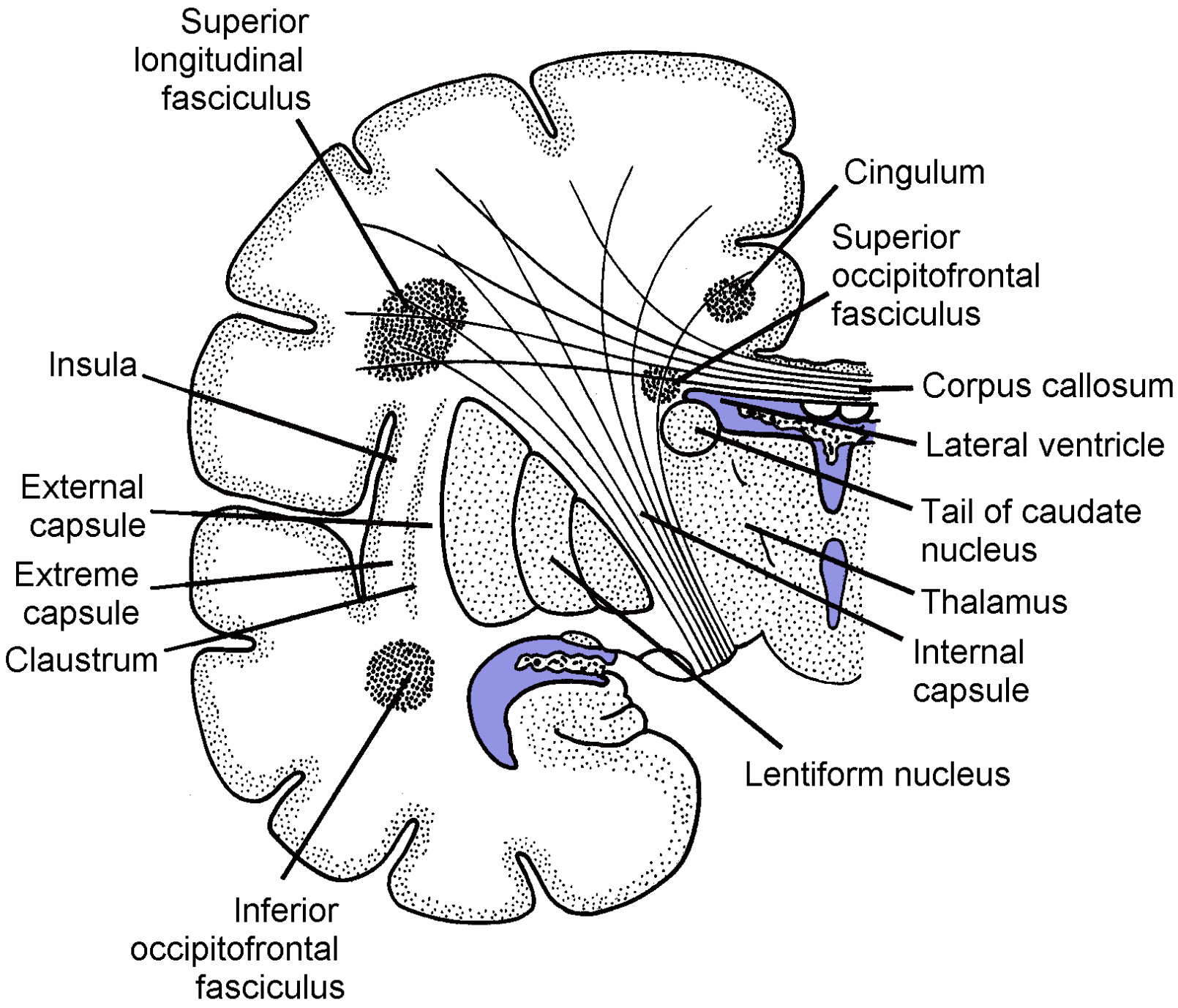

E
OR
23 ± 3.1
V
13 ± 2.5

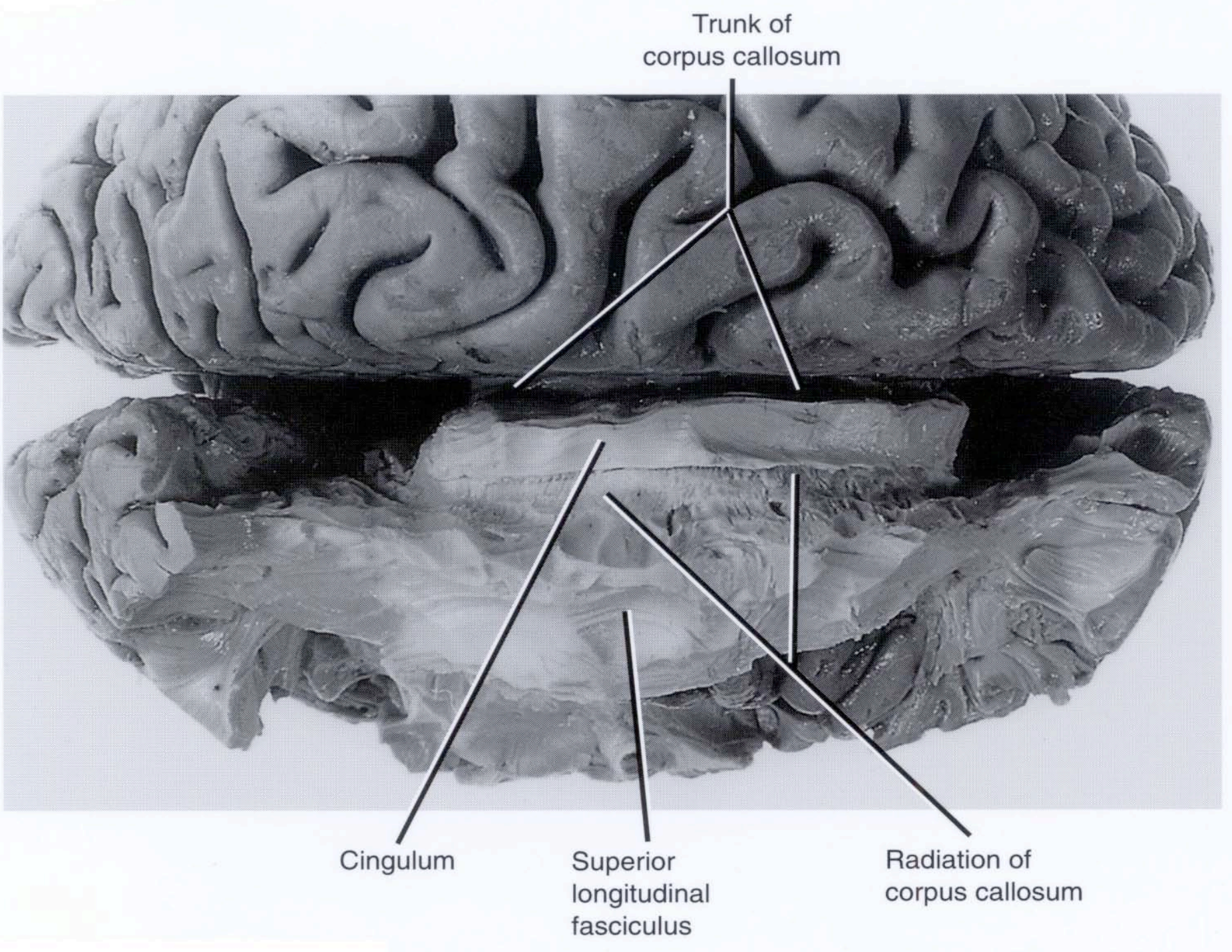

Pu
Pal
T1
A com
5
4
3
1
2
Ot
T2
T3
TCA

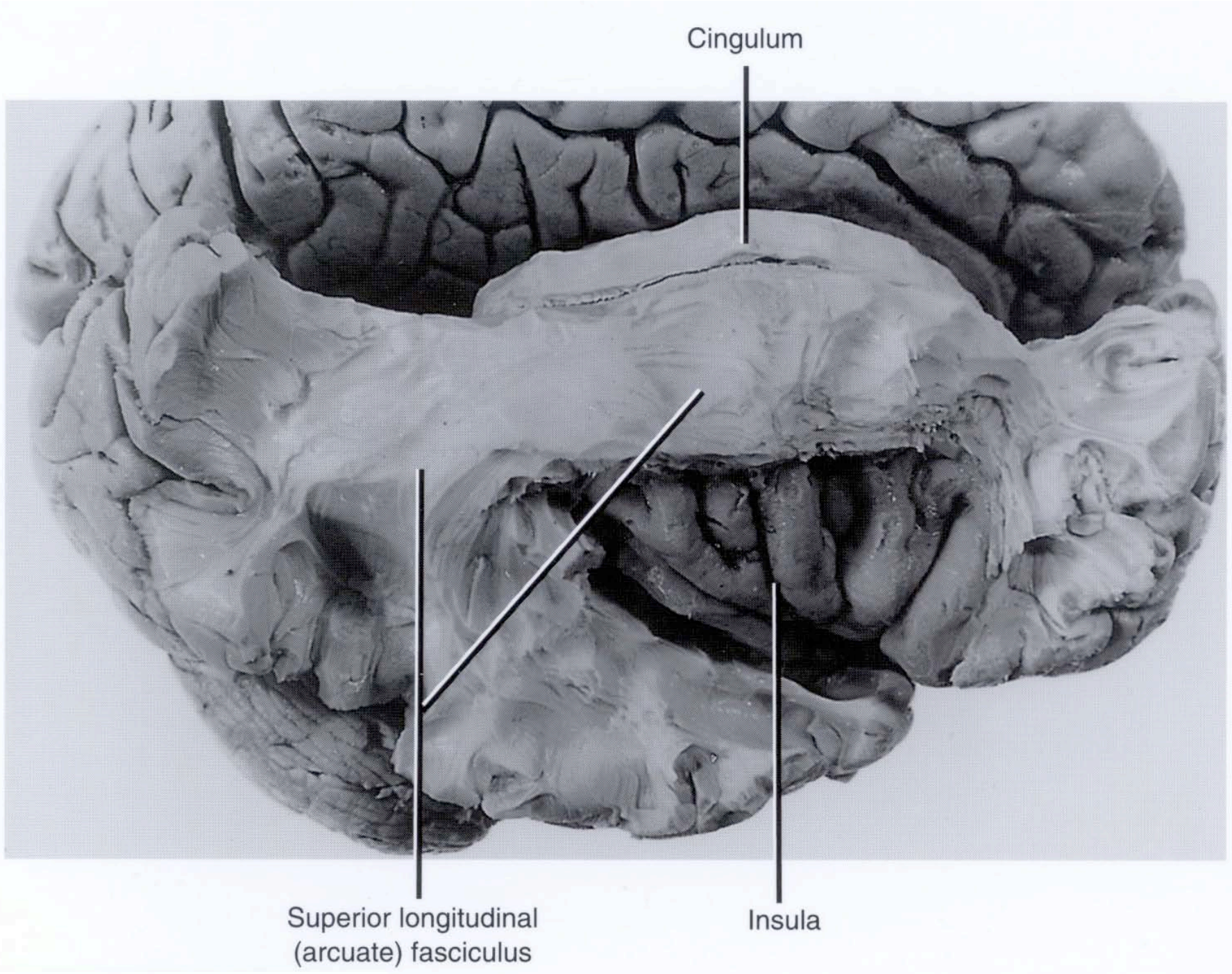

B
Front. Lobe
Temp. Lobe
M1
M2
M2
Limen Insula
Sup. Syl. V.
Inf. Insular Sulcus
Insula

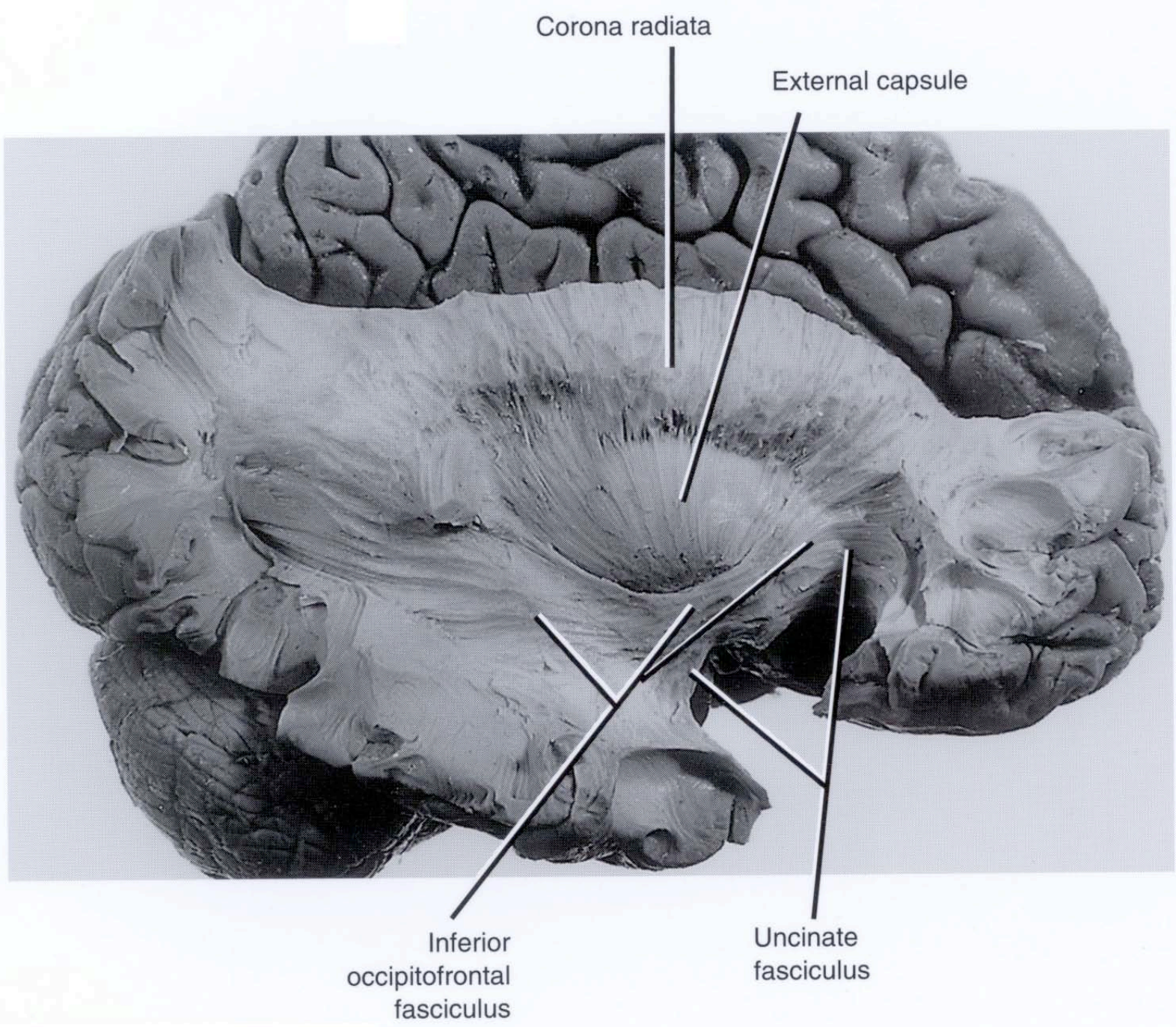

C
Temp. Lobe
M1
M2
M2
Limen Insula
Hippo. Head
Temp. Horn
Insula
Chor. Plex.

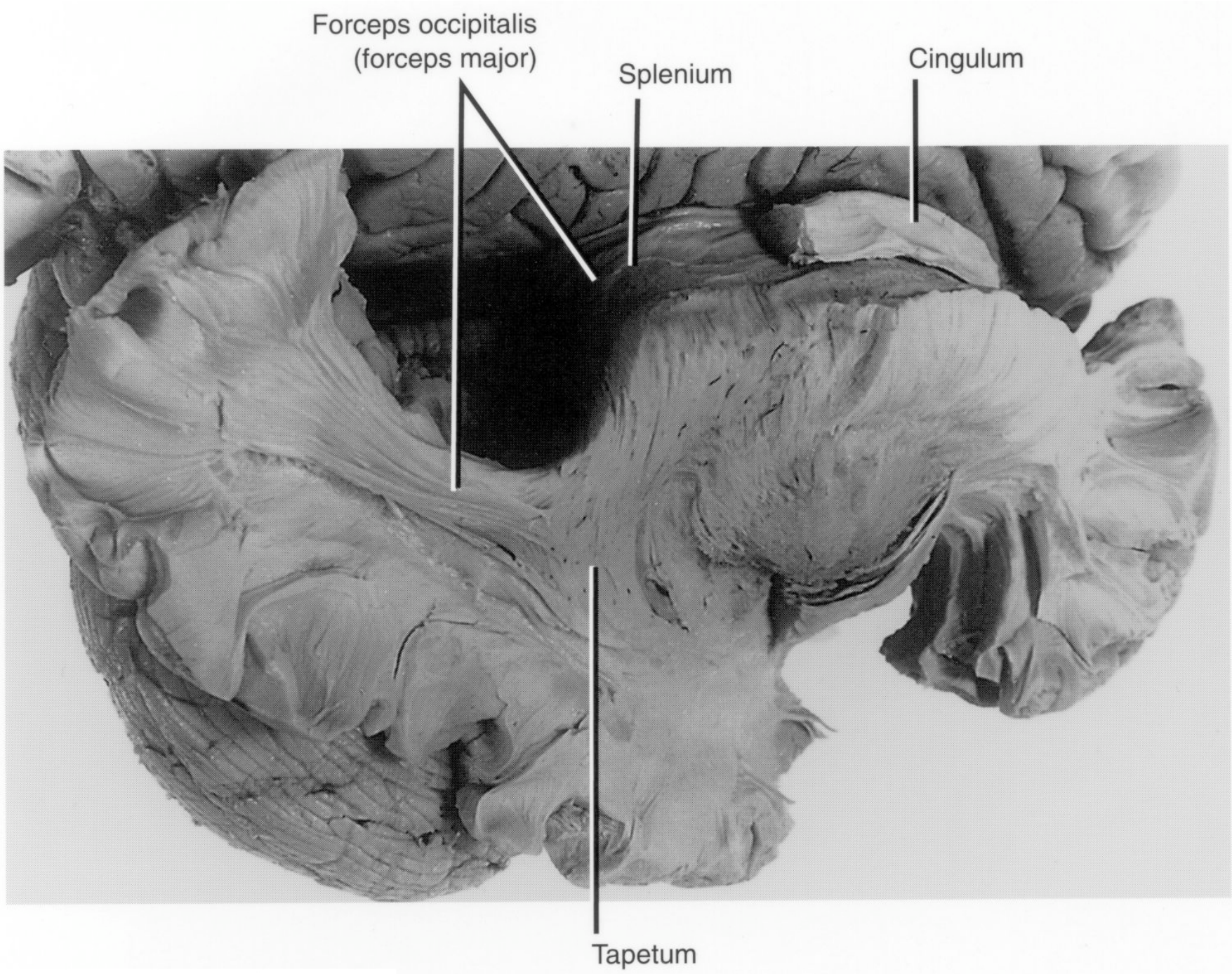

E
Ant. Sep.
Apex
M1
Amygdala
Hippo. Head
Limen Insula
M2

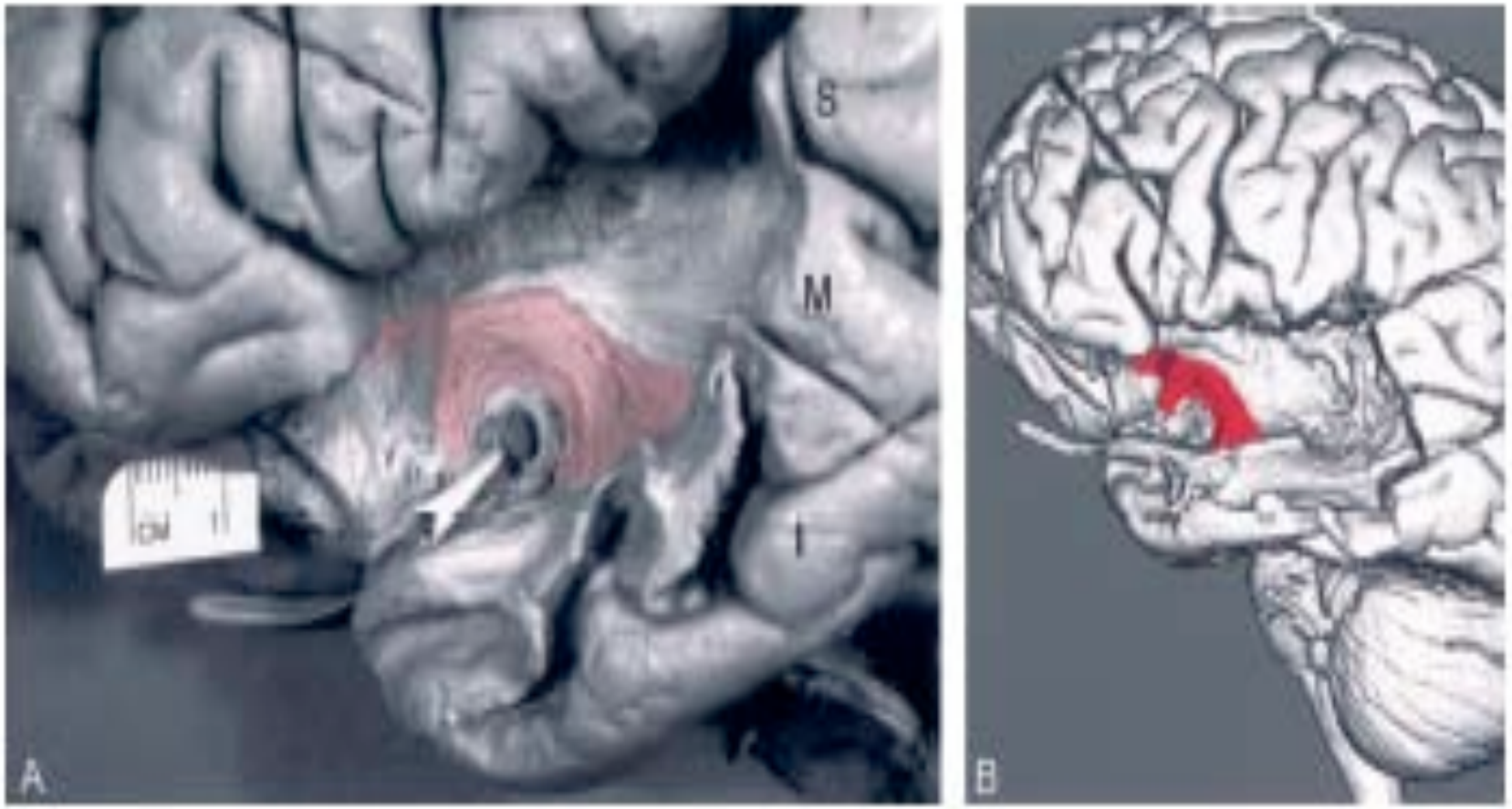

Superior longitudinal fasciculus
Cingulum
Superior occipitofrontal fasciculus
Insula
Corpus callosum
Lateral ventricle
External capsule
Tail of caudate nucleus
Extreme capsule
Thalamus
Claustrum
Internal capsule
Lentiform nucleus
Inferior occipitofrontal fasciculus

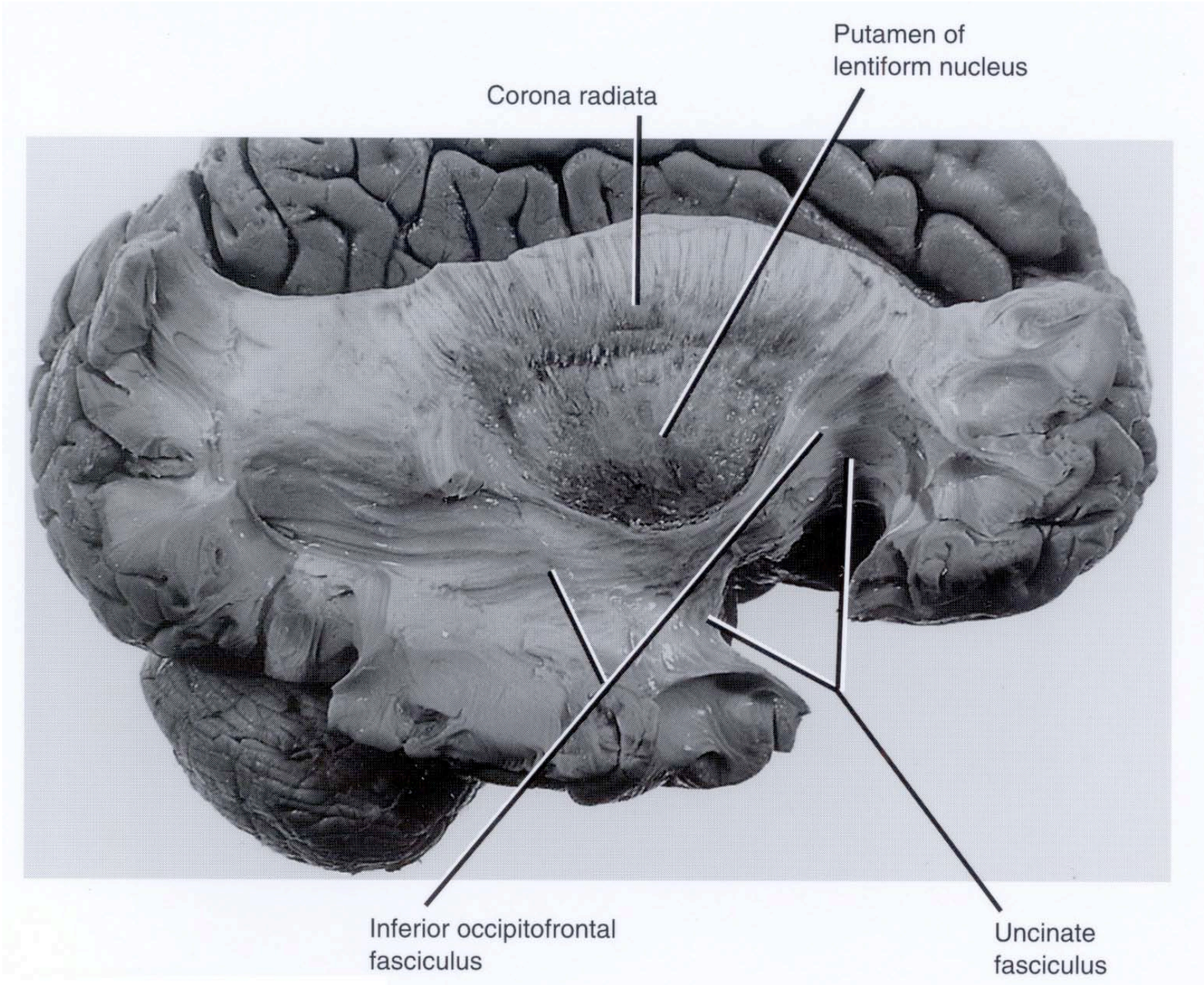

Trunk of
corpus callosum
Cingulum
Superior
longitudinal
fasciculus
Radiation of
corpus callosum


Cingulum
Superior longitudinal
(arcuate) fasciculus
Insula

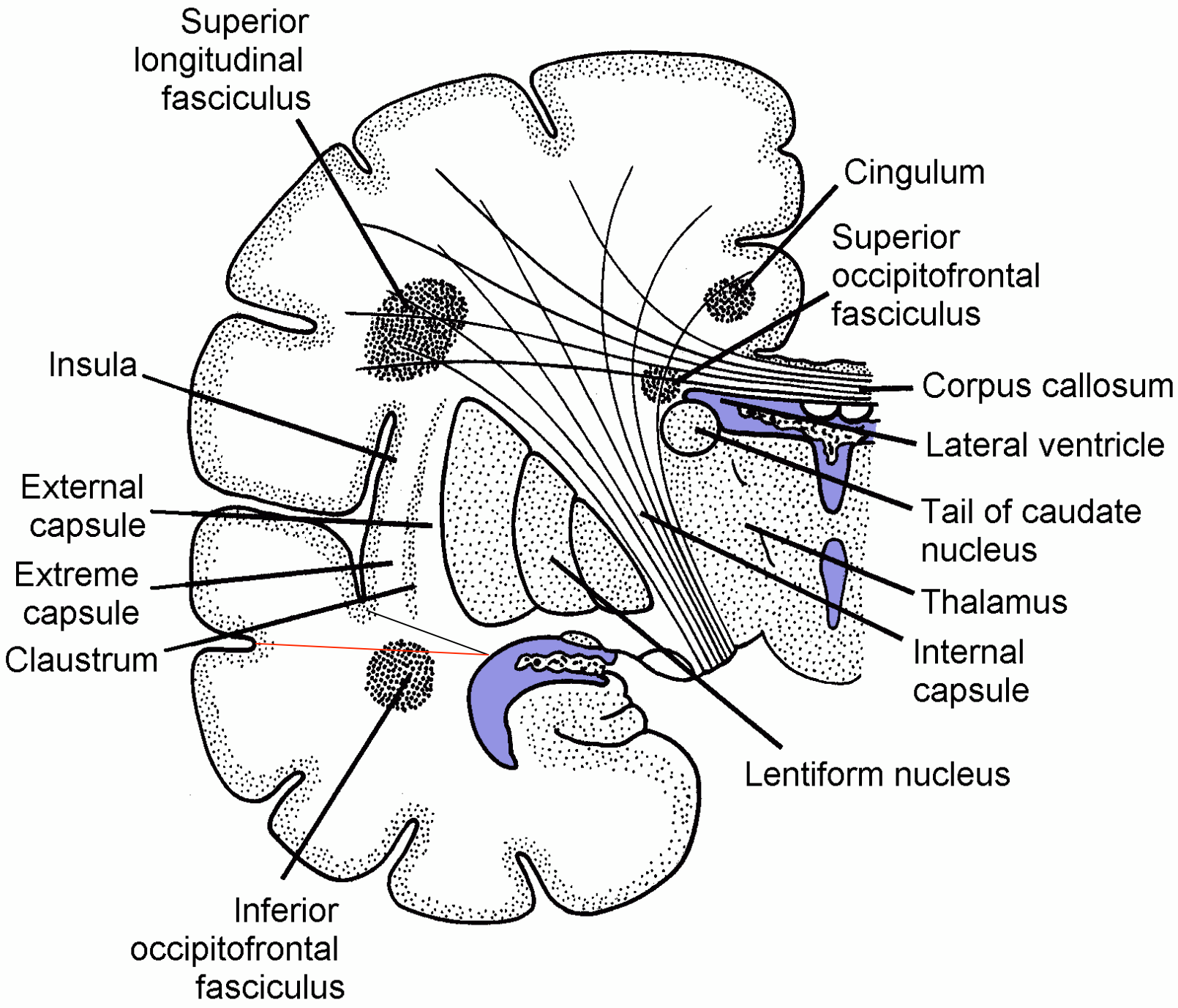

Corona radiata
External capsule
Inferior occipitofrontal fasciculus
Uncinate fasciculus


Forceps occipitalis
(forceps major)
Splenium
Cingulum
Tapetum


S
M
I
A
B


Putamen of
lentiform nucleus
Corona radiata
Inferior occipitofrontal
fasciculus
Uncinate
fasciculus

The temporal stem.


Superior longitudinal fasciculus
Cingulum
Superior occipitofrontal fasciculus
Insula
Corpus callosum
Lateral ventricle
External capsule
Tail of caudate nucleus
Extreme capsule
Thalamus
Claustrum
Internal capsule
Lentiform nucleus
Inferior occipitofrontal fasciculus

The temporal stem, Albal stalk.

- Thin band of white matter that forms a bridge between the medullary core of the temporal lobe and the inferior frontal lobe.

- Boundaries.
  - Anterior, the Amygdala.
  - Posterior, the lateral geniculate body.

The uncinate fasiculus. UF.

- Can be divided into the temporal, insular and frontal segments.

- Temporal segment.
  - Originates from the cortical nuclei of the amygdala, area 28,34 and 36. and the anterior three temporal convulsions, area 20 and 38, in front of the temporal horn.

- Area 20, inferior temporal area.
- Area 28, Entorhinal area.
- Area 34,dorsal entorhinal area.
- Area 36, Ectorhinal area. Lateral to the rhinal sulcus
- Area 38, temporo-polar area.

- All the fibers come together as a solid tract in the anterior temporal stem in the white matter of the middle temporal gyrus anterior of the temporal horn.

- The UF passes upward over the lateral nucleus of the amygdala toward the limen insula.
- The insular segment of the UF, in the limen insula, is situated below the putamen and the claustrum.

- The insular segment of the UF measures 2-5 mm in height and 2-7mm in width.

- The inner fibers of the UF pass thru the external capsule and the outer fibers pass thru the extreme capsule, therefore a part of the clasutrum is imbbeded in the UF.

- In the region of the external and extreme capsules the insular fibers of the UF is inferior to the fibers of the inferior occipito-frontal fasciculus.
- They do merge in this region as well.

- The frontal segment of the UF has a fanlike shape in the fronto-orbital white matter and is oriented in the horizontal plane.

- The frontal fibers are lateral to the lateral edge of the inferior occipito-frontal fasciculus.

- The inferior occipto-frontal fasciculus merges with the UF in the inferior frontal lobe.

- The UF connects the cortical nuclei of the amygdala and the uncus with the subcallosal region.

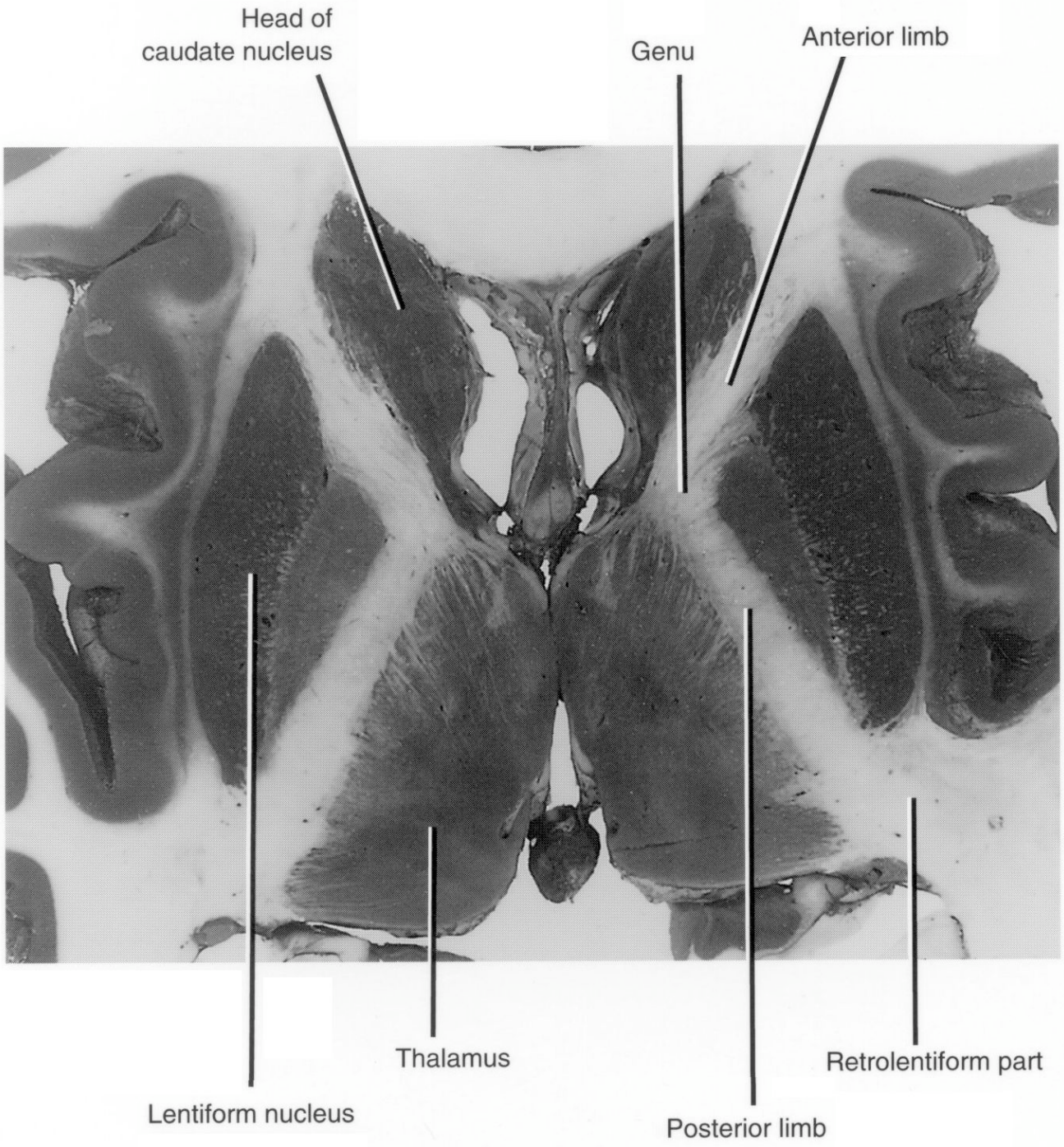
- The tips of the three temporal gyri are connected via the UF with the gyrus rectus and the medial and lateral orbital gyri as well as the orbital segment of the inferior frontal gyrus.

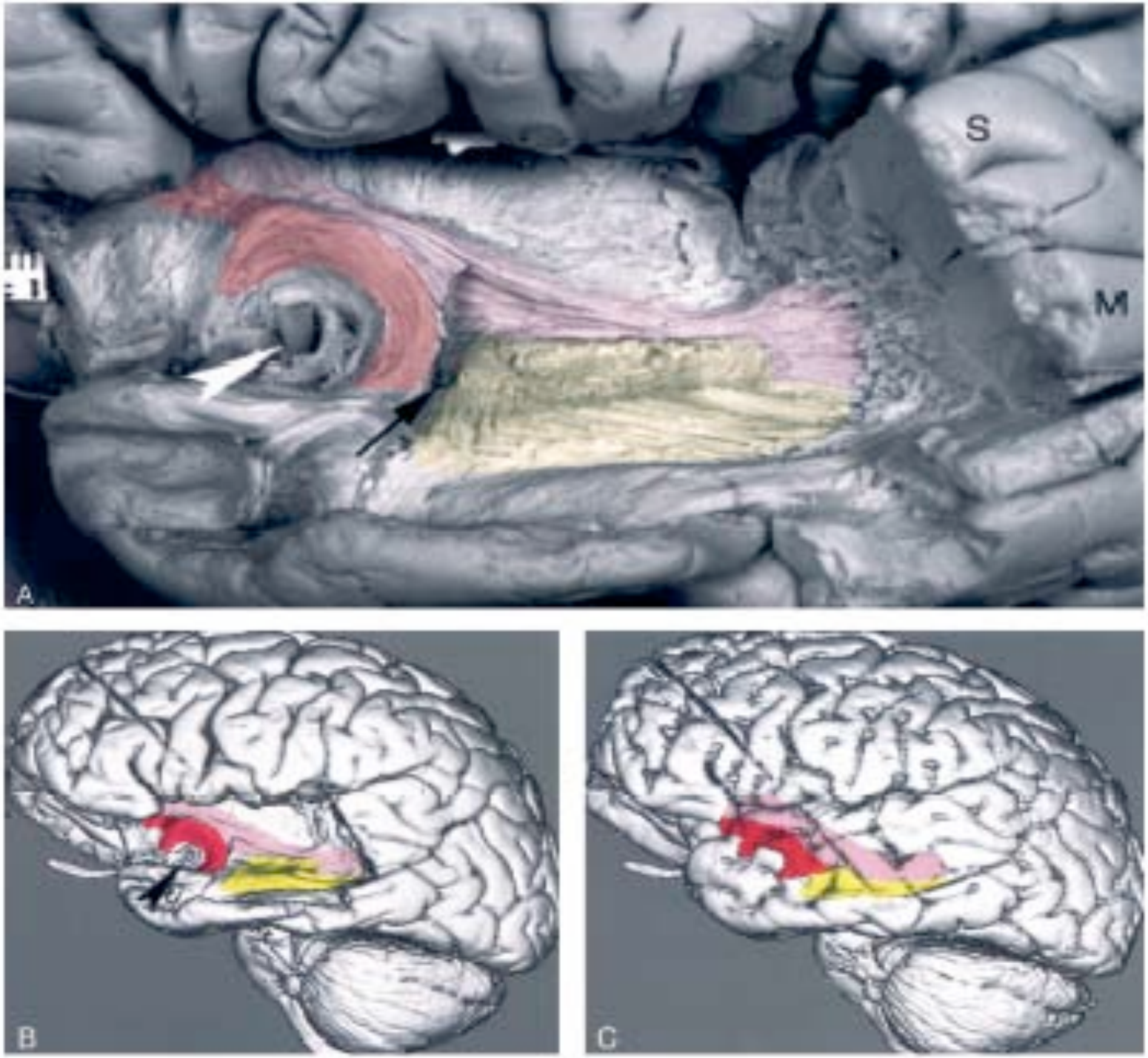
- The UF is a monosynaptic cortico-cortical route of interaction between the temporal and frontal lobes.

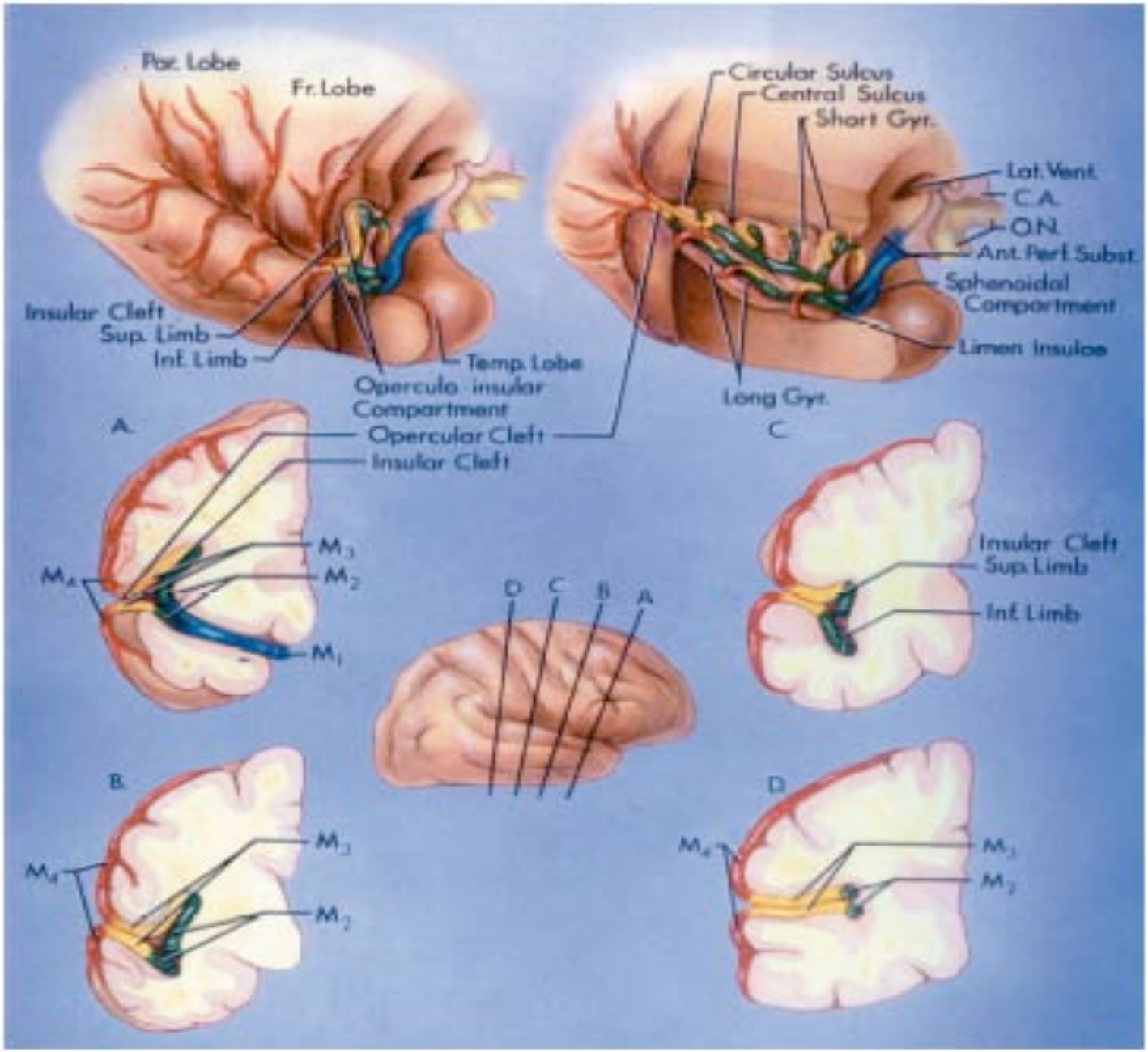
- Clinically the UF disruption may be responsible for the post-traumatic retrograde amnesia.

The inferior occipito-frontal fasciculus. IOFF.

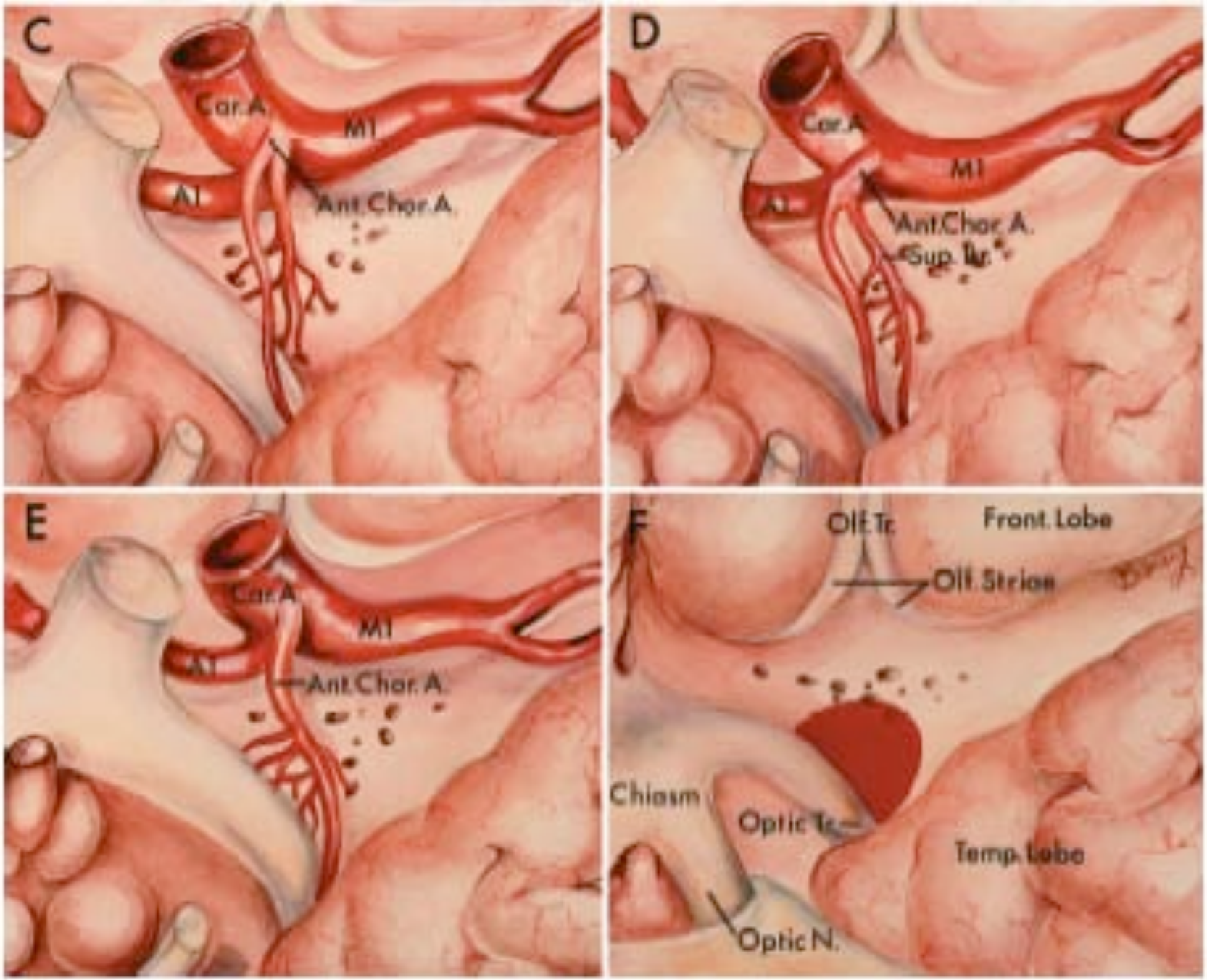
- Prominent component of the temporal stem.
- Rarely mentioned and often confused with the UF.
- It connects the occipital lobe,

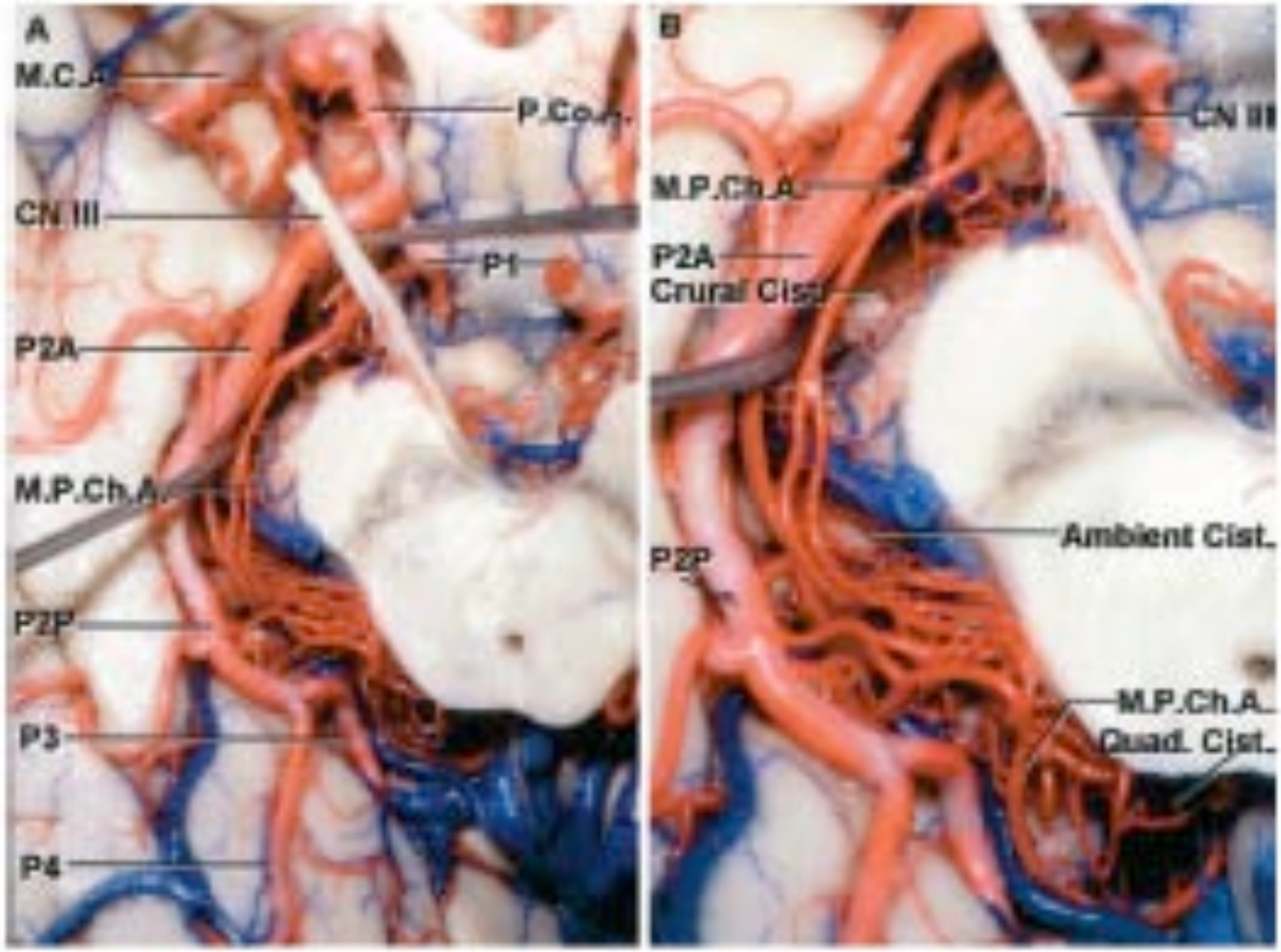

Head of caudate nucleus
Genu
Anterior limb
Thalamus
Lentiform nucleus
Posterior limb
Retrolentiform part

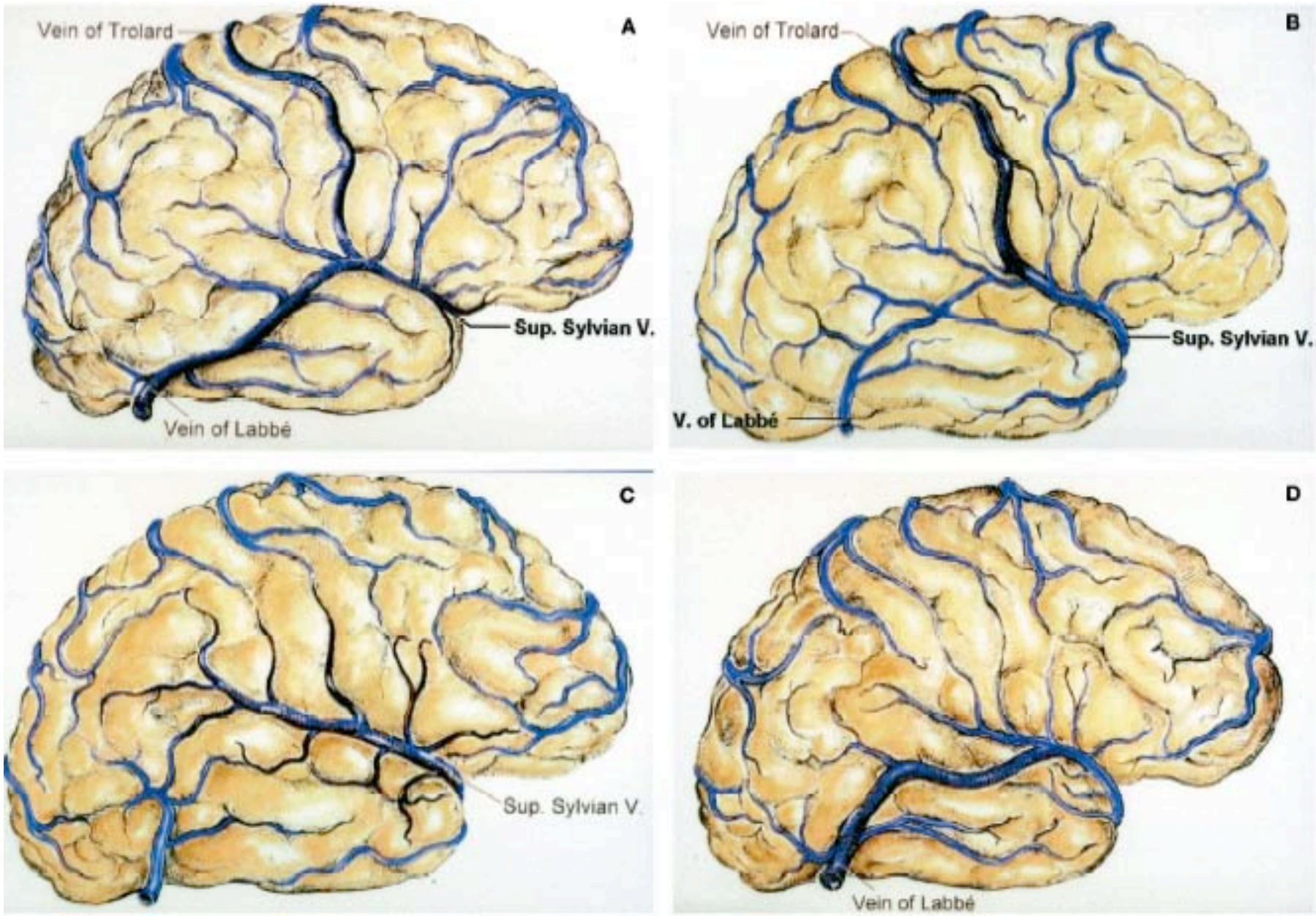

S
M
A
B
C

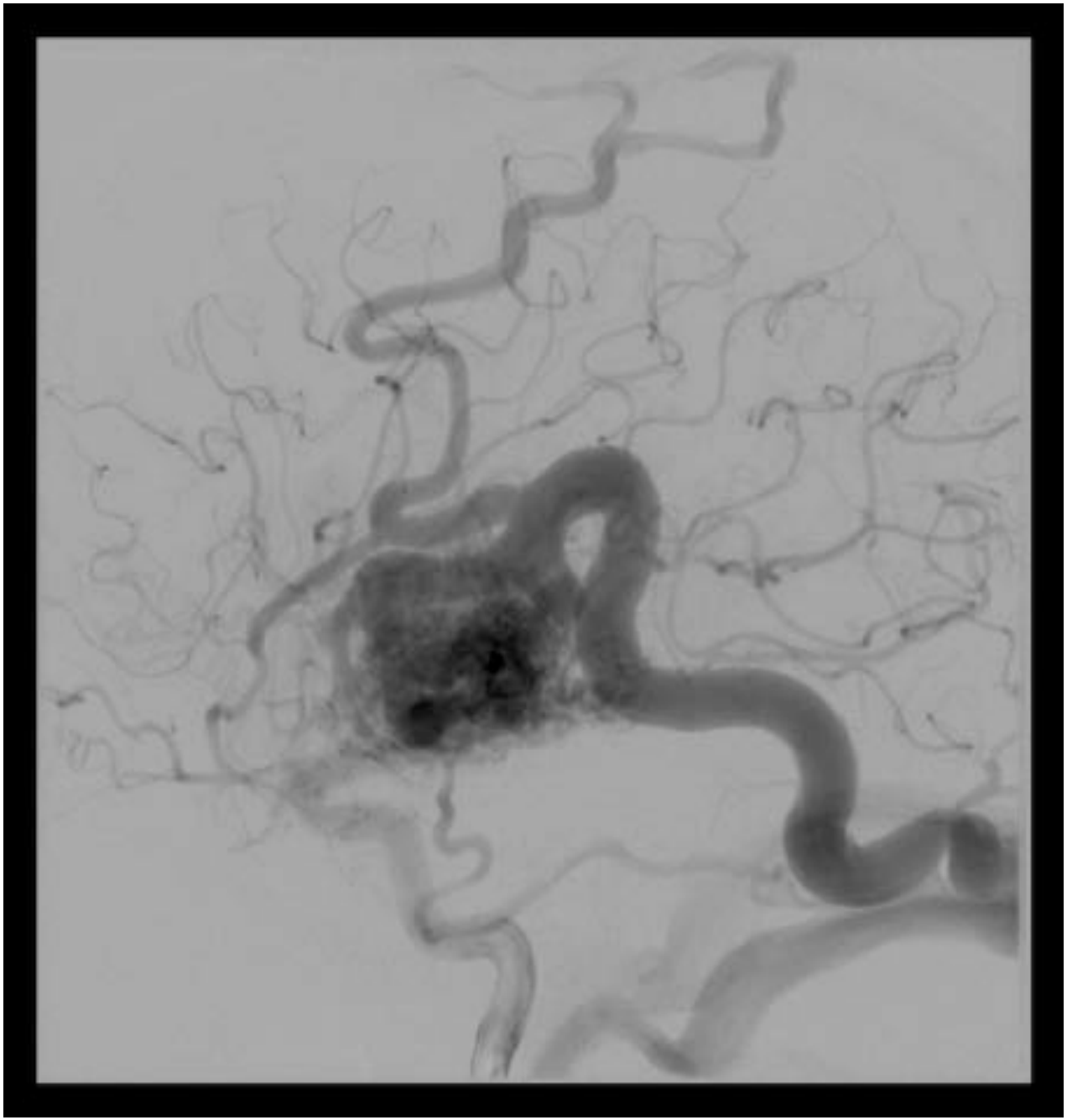

Par. Lobe
Fr. Lobe
Insular Cleft
Sup. Limb
Inf. Limb
Temp. Lobe
Operculo-insular Compartment
Circular Sulcus
Central Sulcus
Short Gyr.
Lat. Vent.
C.A.
O.N.
Ant. Perf. Subst.
Sphenoidal Compartment
Limen Insulae
Long Gyr.
A.
Opercular Cleft
Insular Cleft
M3
M2
M4
M1
D C B A
C.
Insular Cleft
Sup. Limb
Inf. Limb
B.
M3
M4
M2
D.
M4
M3
M2

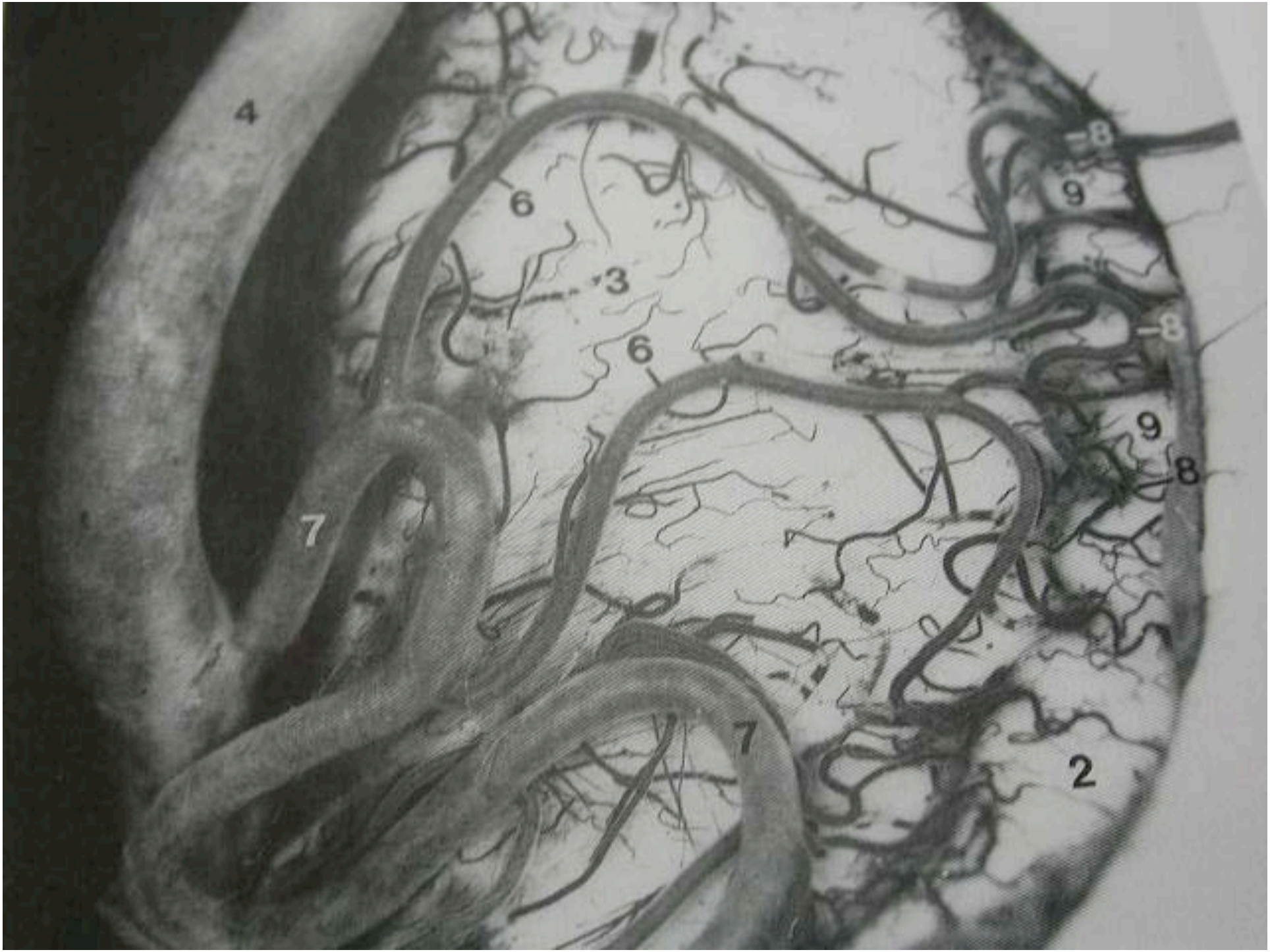

Rec. A.
Caud. A.
M2
Lat. Lent. Str. A.
Int. Lent. Str. A.
Med. Lent. Str. A.
Ant. Chor. A.
Ant. Per. A.

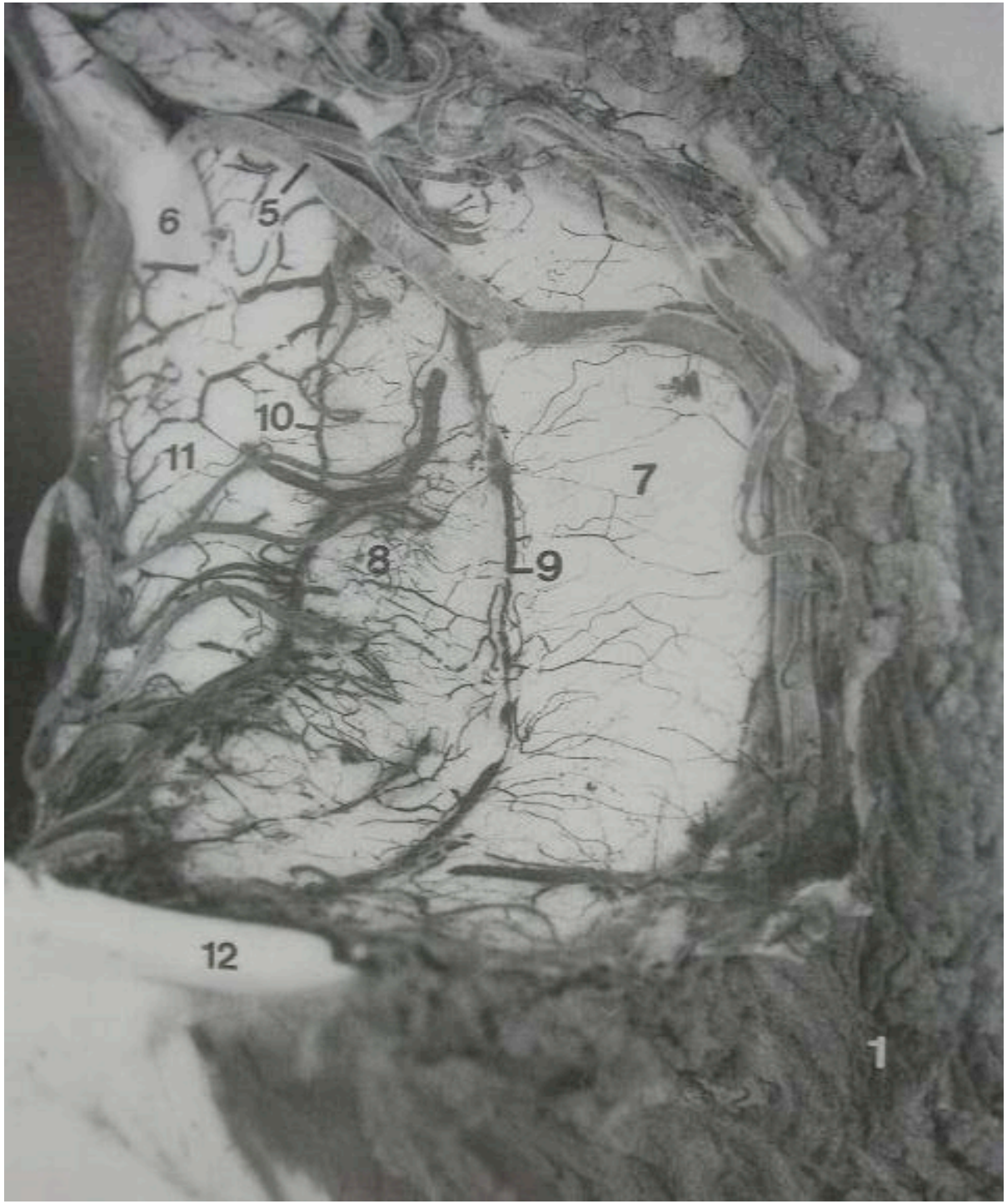

C
Car.A.
M1
A1
Ant.Chor.A.
D
Car.A.
M1
A1
Ant.Chor.A.
Sup. Br.
E
Car.A.
M1
A1
Ant.Chor.A.
F
Olf.Tr.
Front.Lobe
Olf.Striae
Chiasm
Optic Tr.
Temp. Lobe
Optic N.

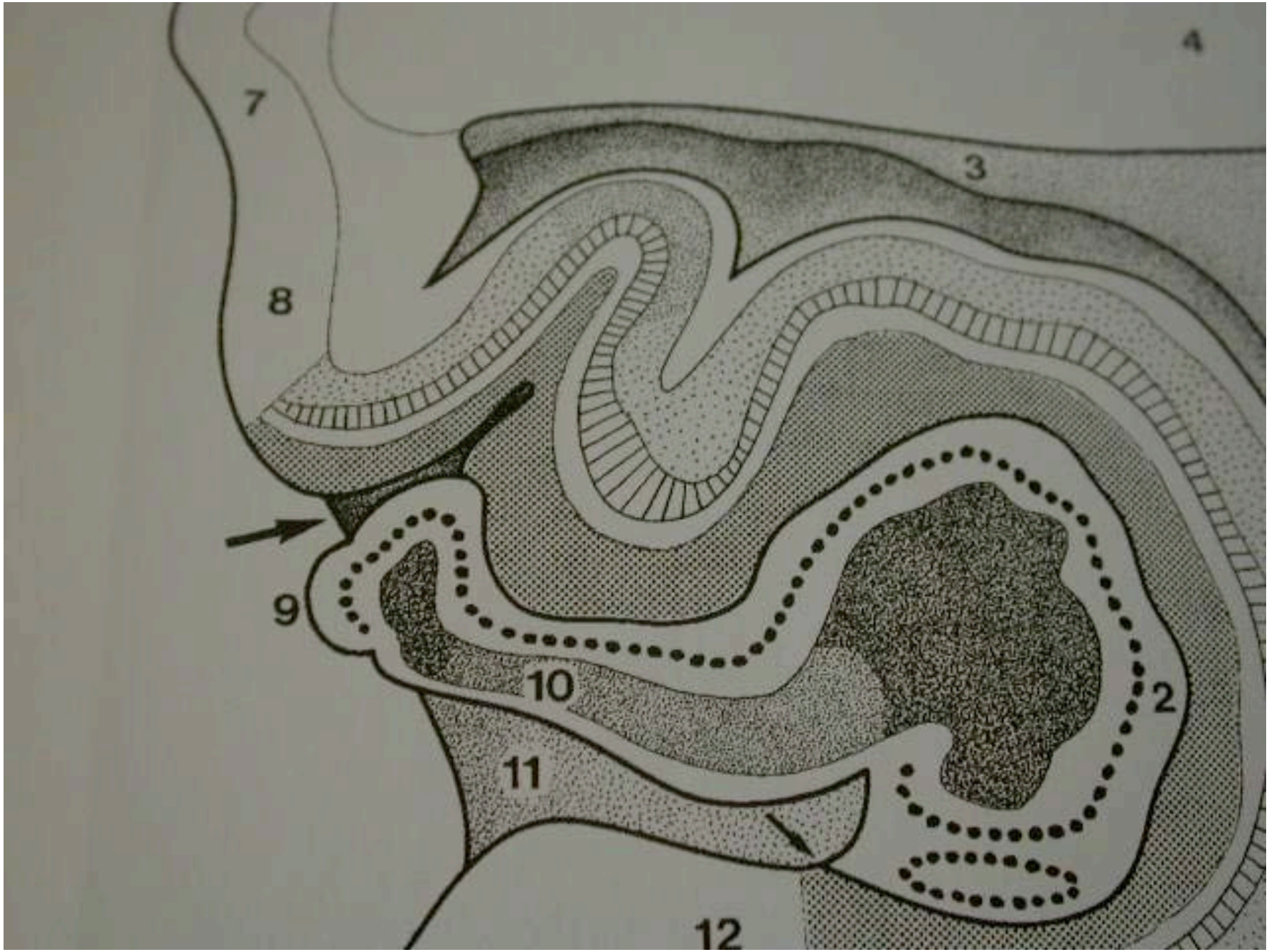

A
M.C.A.
P.Co.A.
CN III
P1
P2A
M.P.Ch.A.
P2P
P3
P4
B
CN III
M.P.Ch.A.
P2A
Crural Cist.
Ambient Cist.
P2P
M.P.Ch.A.
Quad. Cist.


A
Vein of Trolard
Sup. Sylvian V.
Vein of Labbé
B
Vein of Trolard
Sup. Sylvian V.
V. of Labbé
C
Sup. Sylvian V.
D
Vein of Labbé

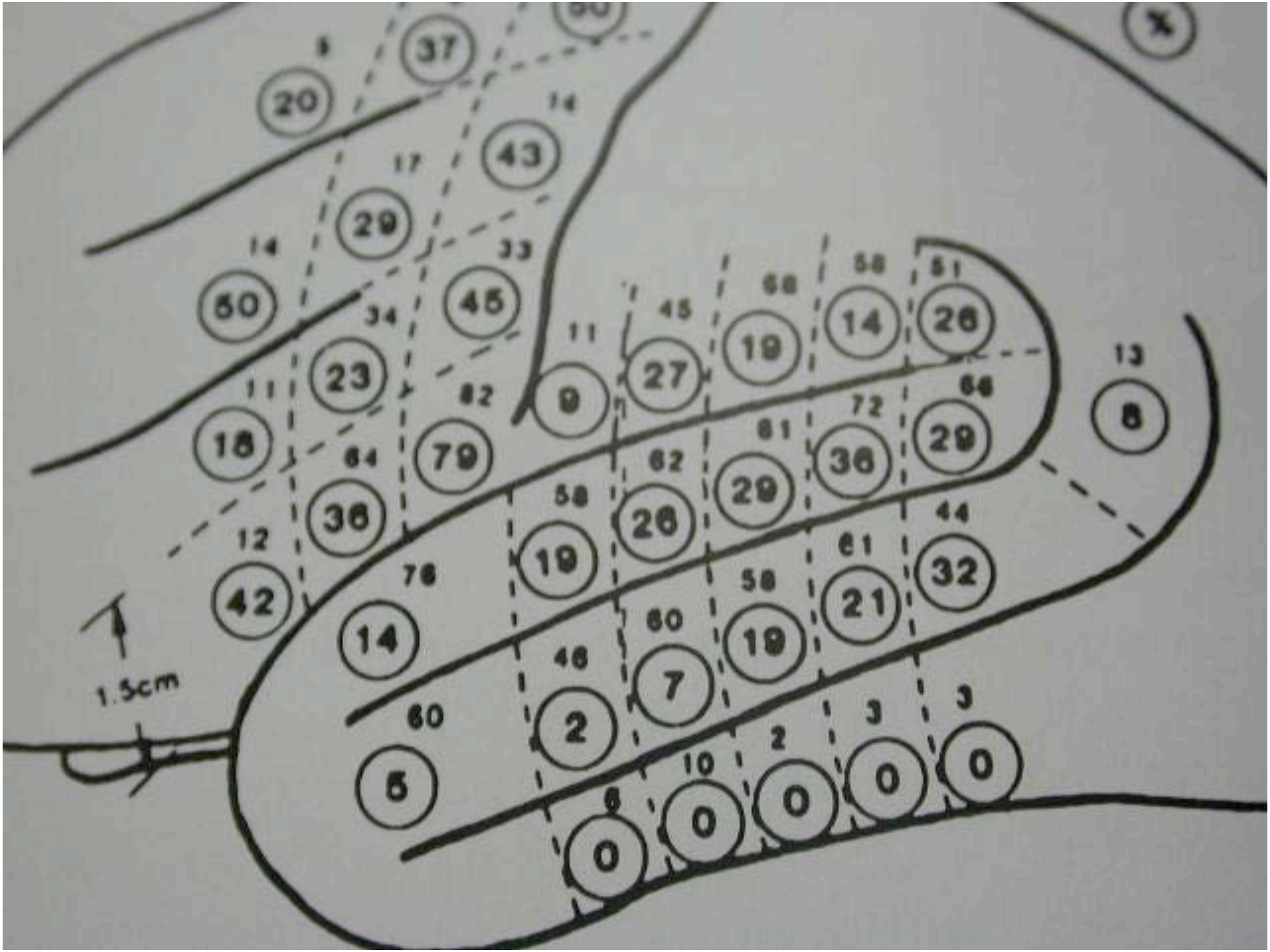


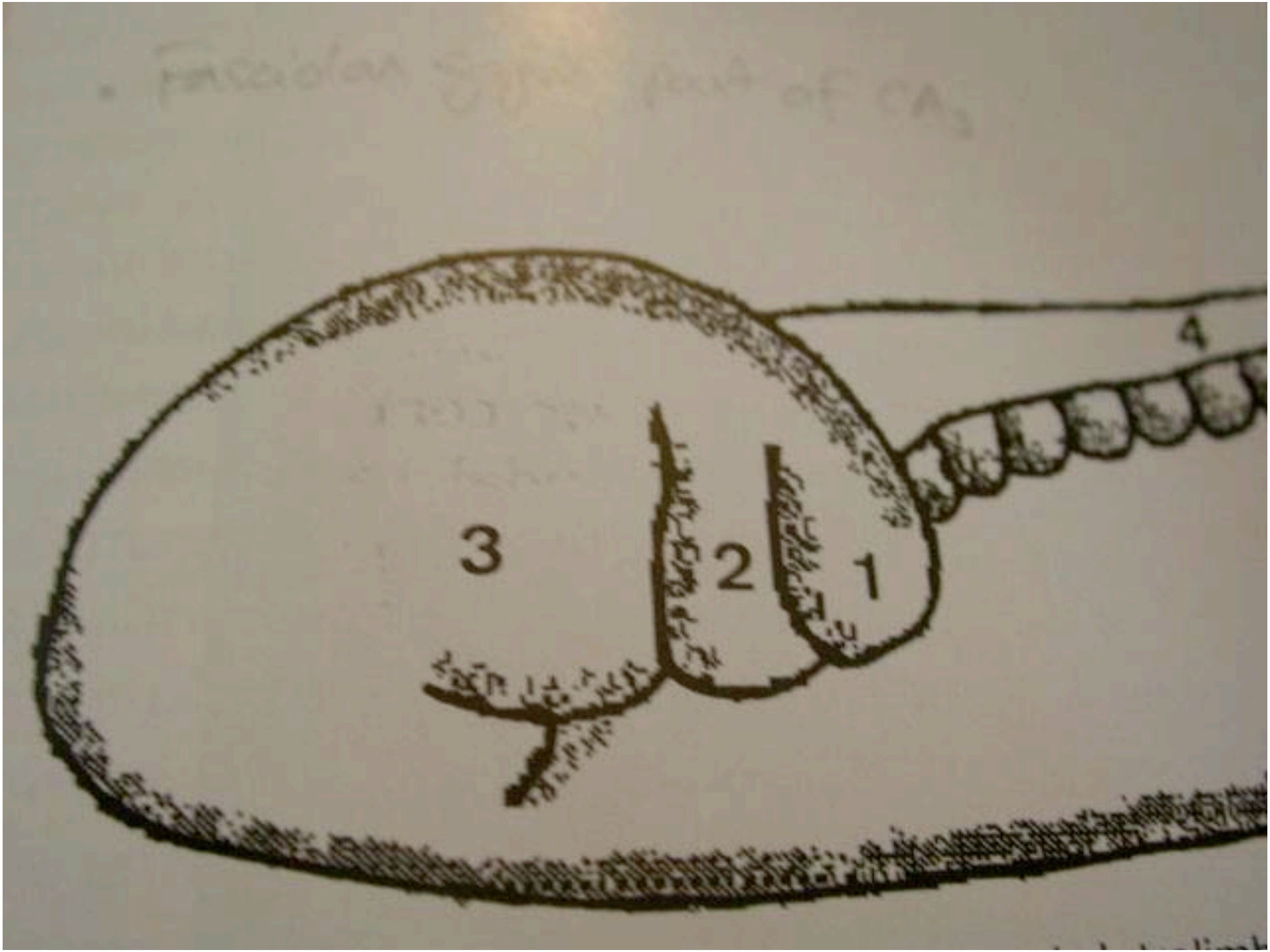

4
6
3
6
8
9
8
9
8
7
7
2

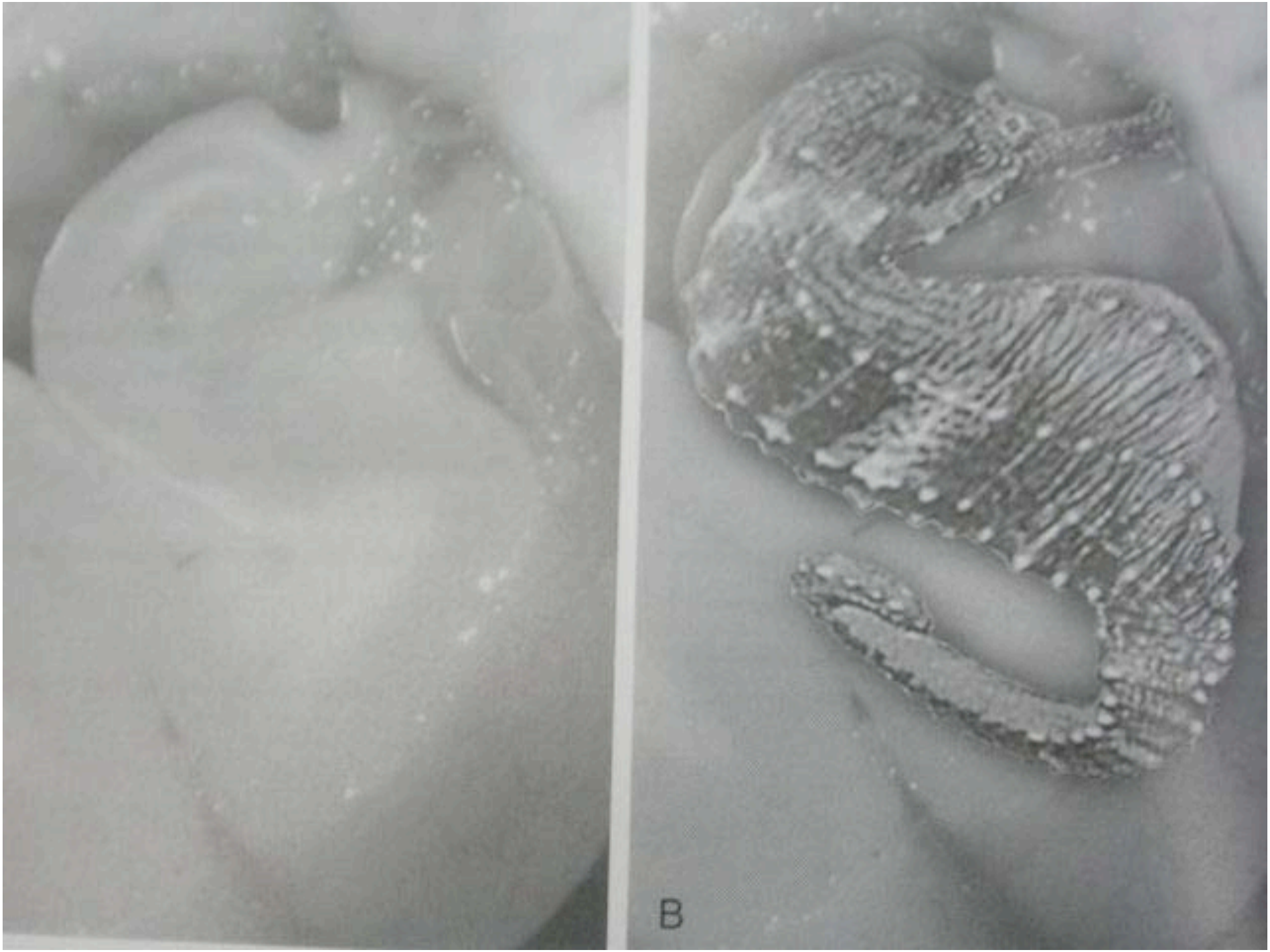

6
5
10
11
7
8
9
12
1

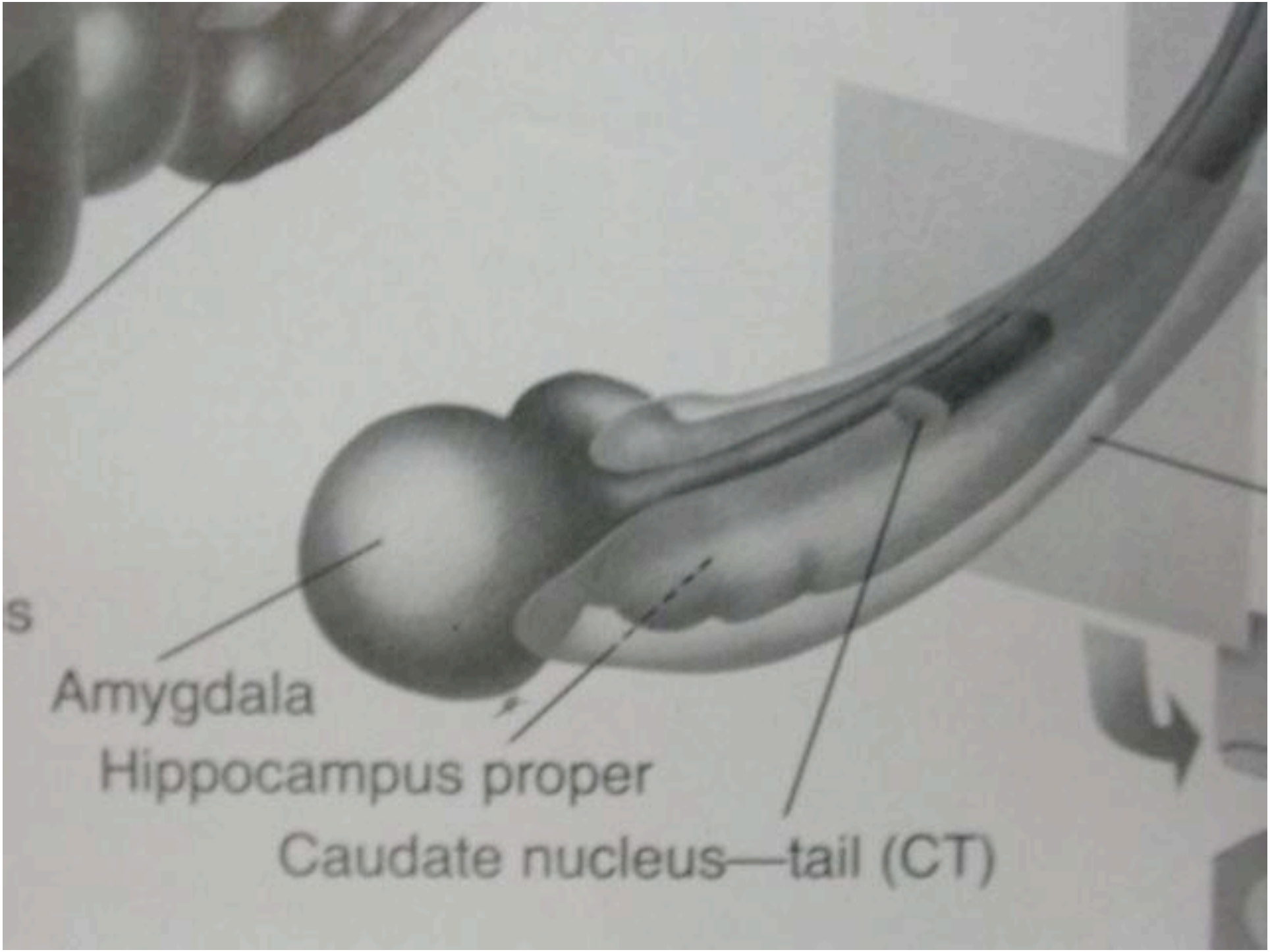

4
7
3
8
9
10
2
11
12

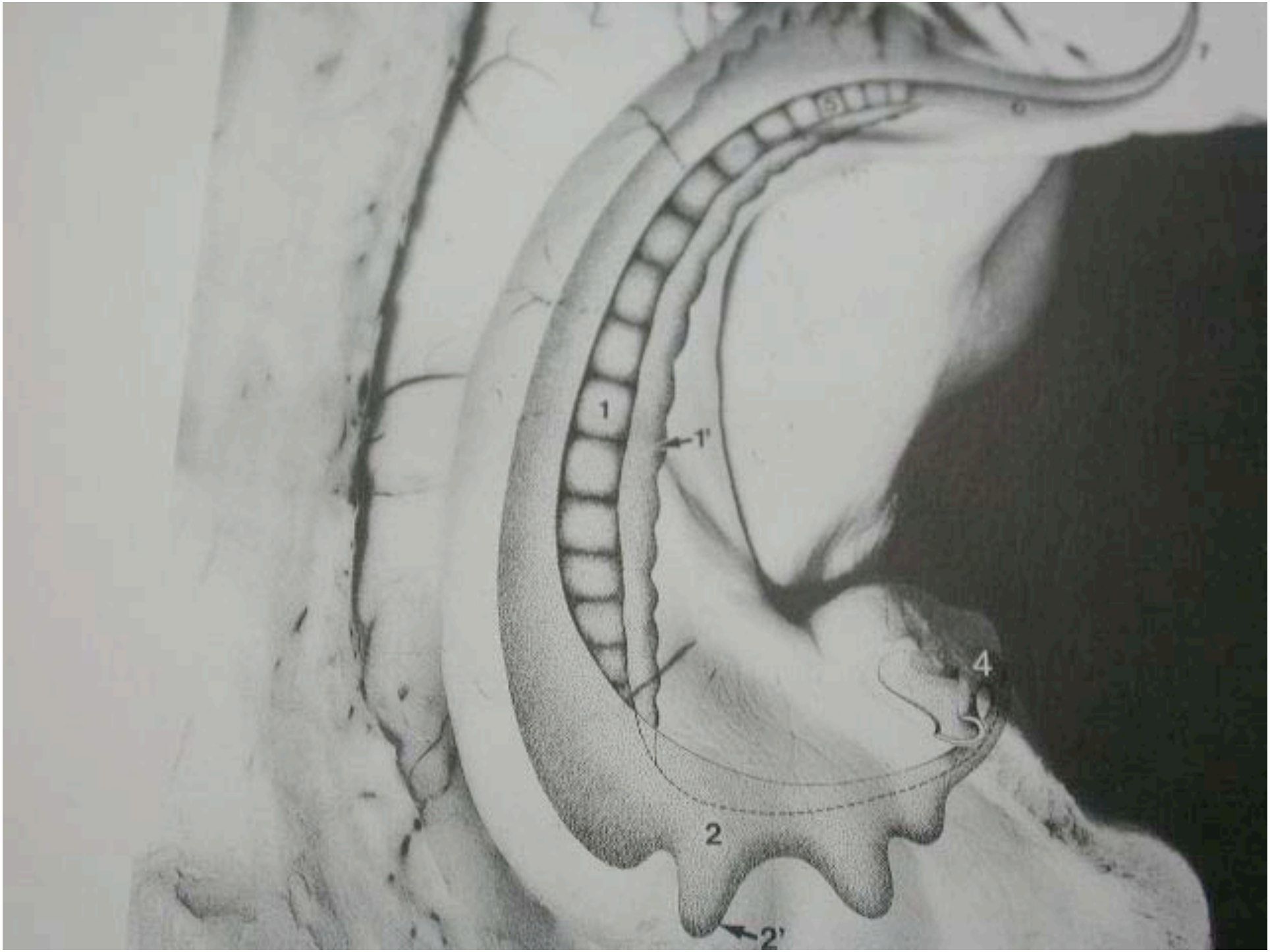

8
3
2
9
10
11


1.5cm


4
3
2
1

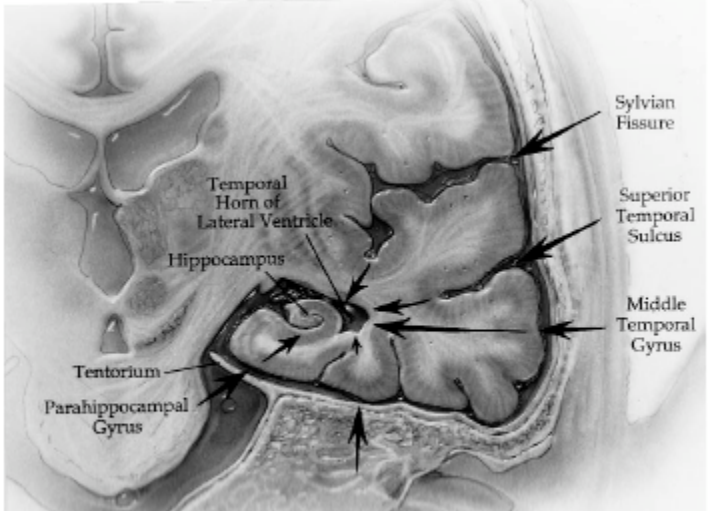

B

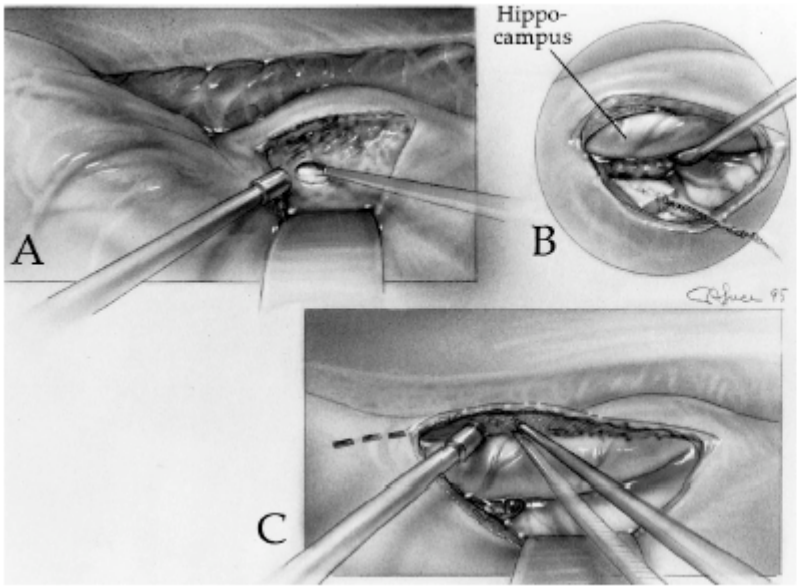

s
Amygdala
Hippocampus proper
Caudate nucleus—tail (CT)

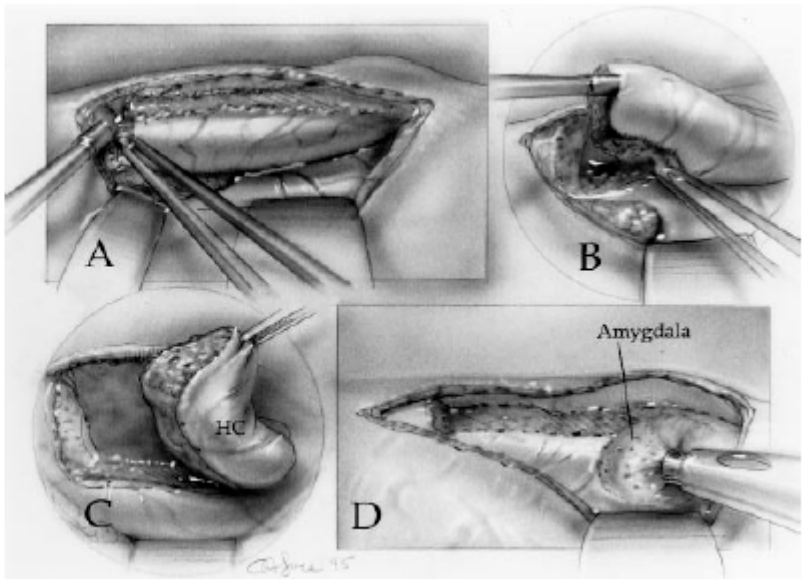

1
1'
2
2'
3
4
5

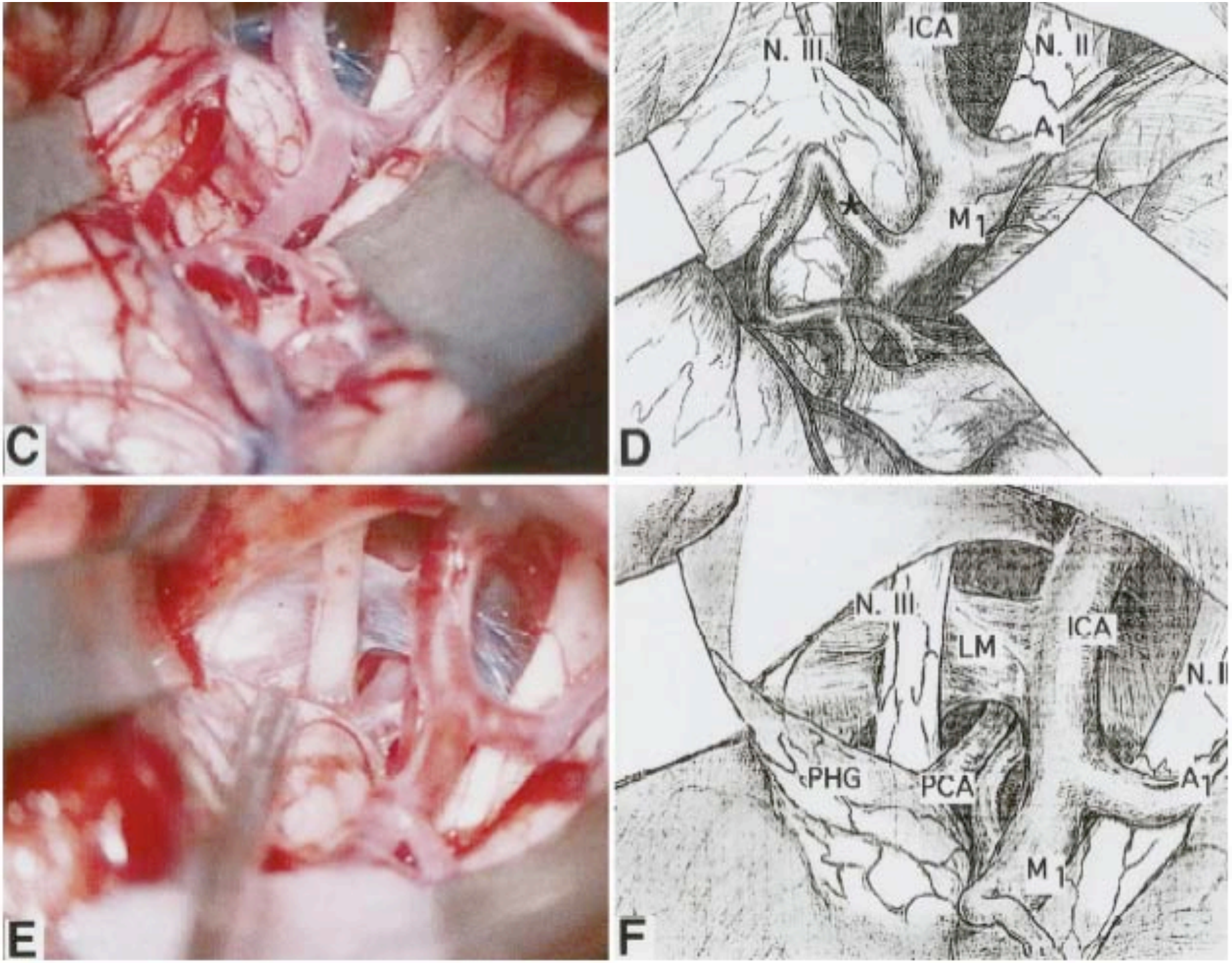
Subtemporal transparahippocampal amygdalohippocampectomy for surgical treatment of mesial temporal lobe epilepsy

Technical note








C
D
N. III
ICA
N. II
A1
M1
E
F
N. III
LM
ICA
N. II
PHG
PCA
A1
M1

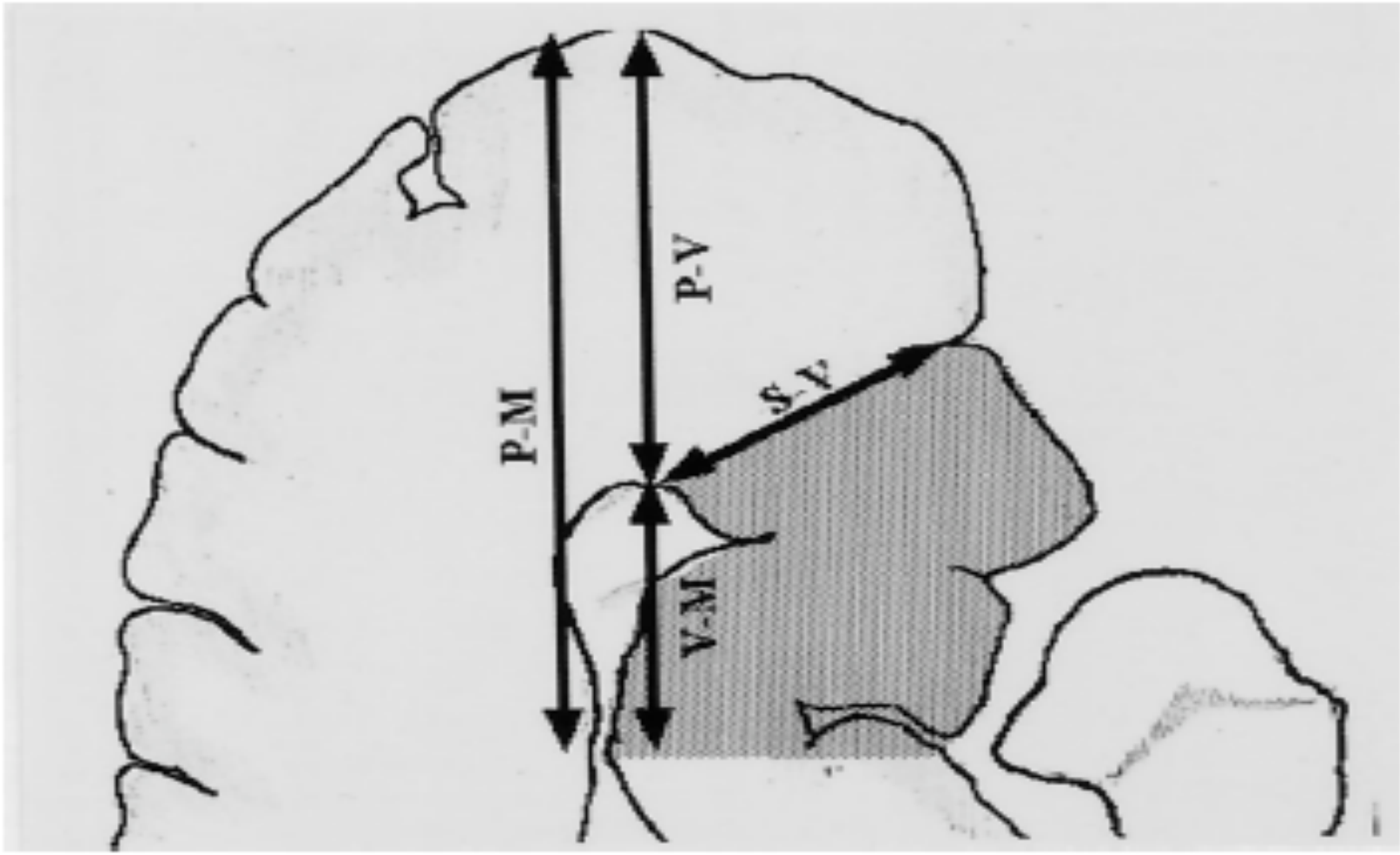
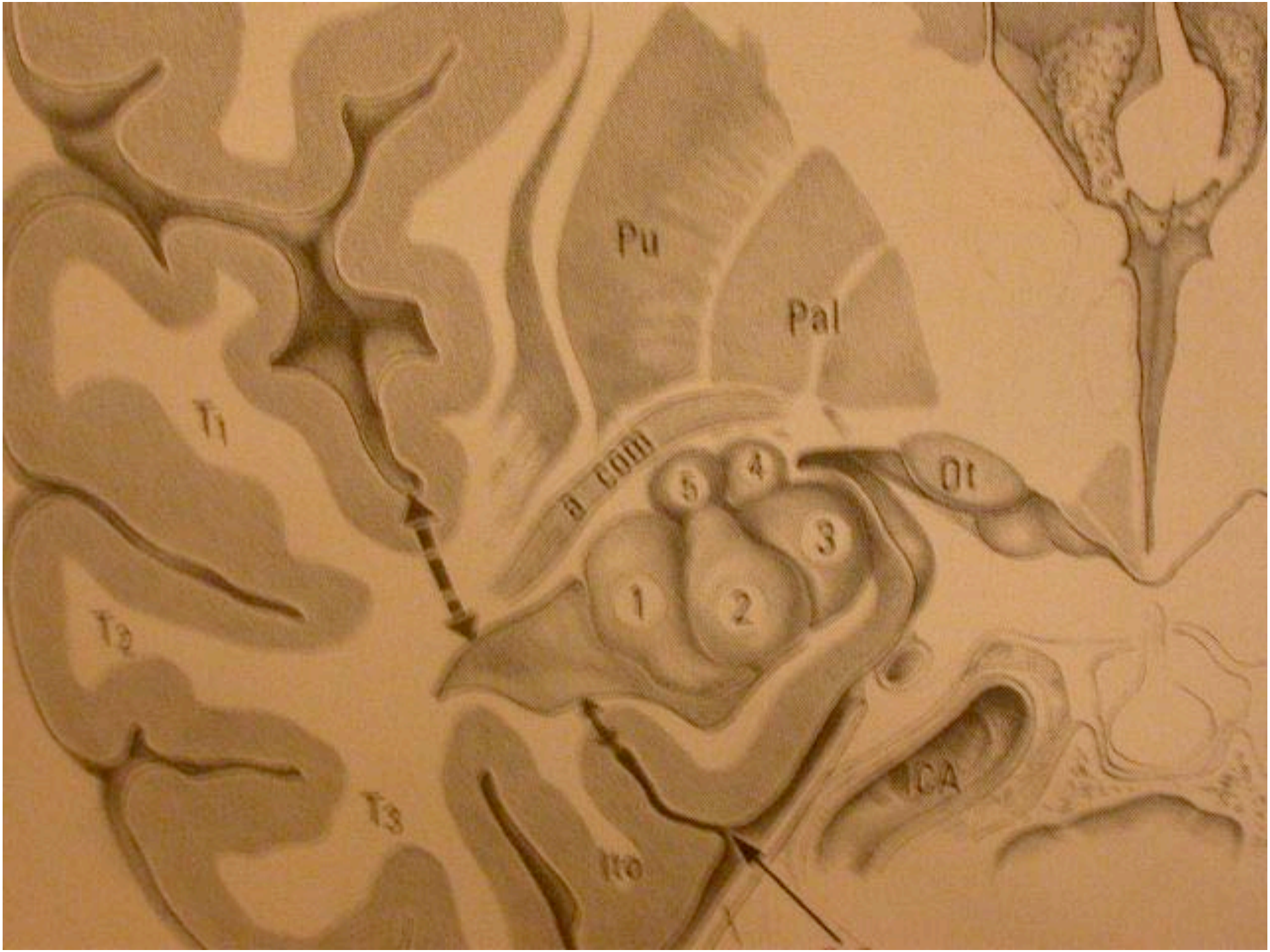
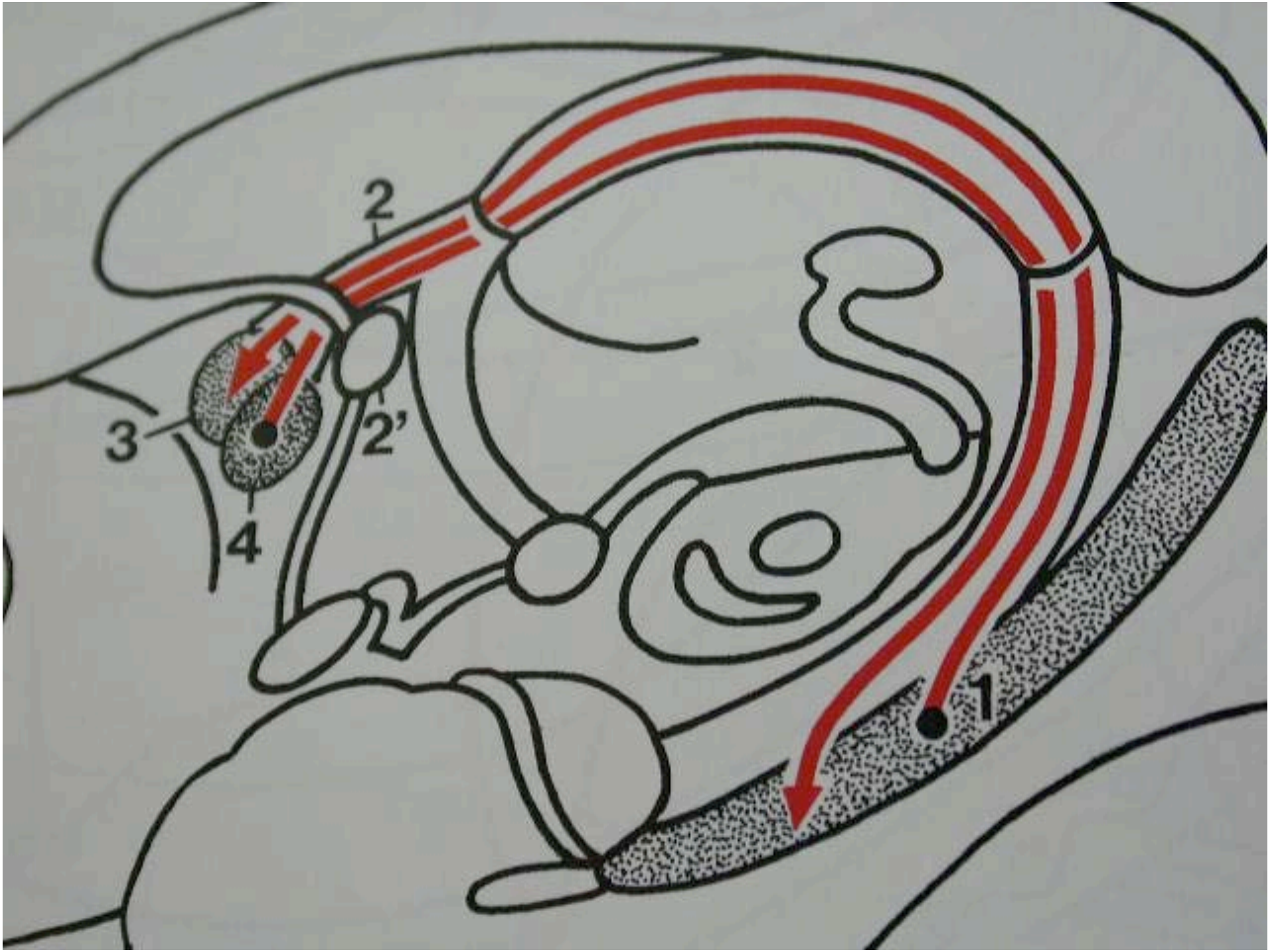
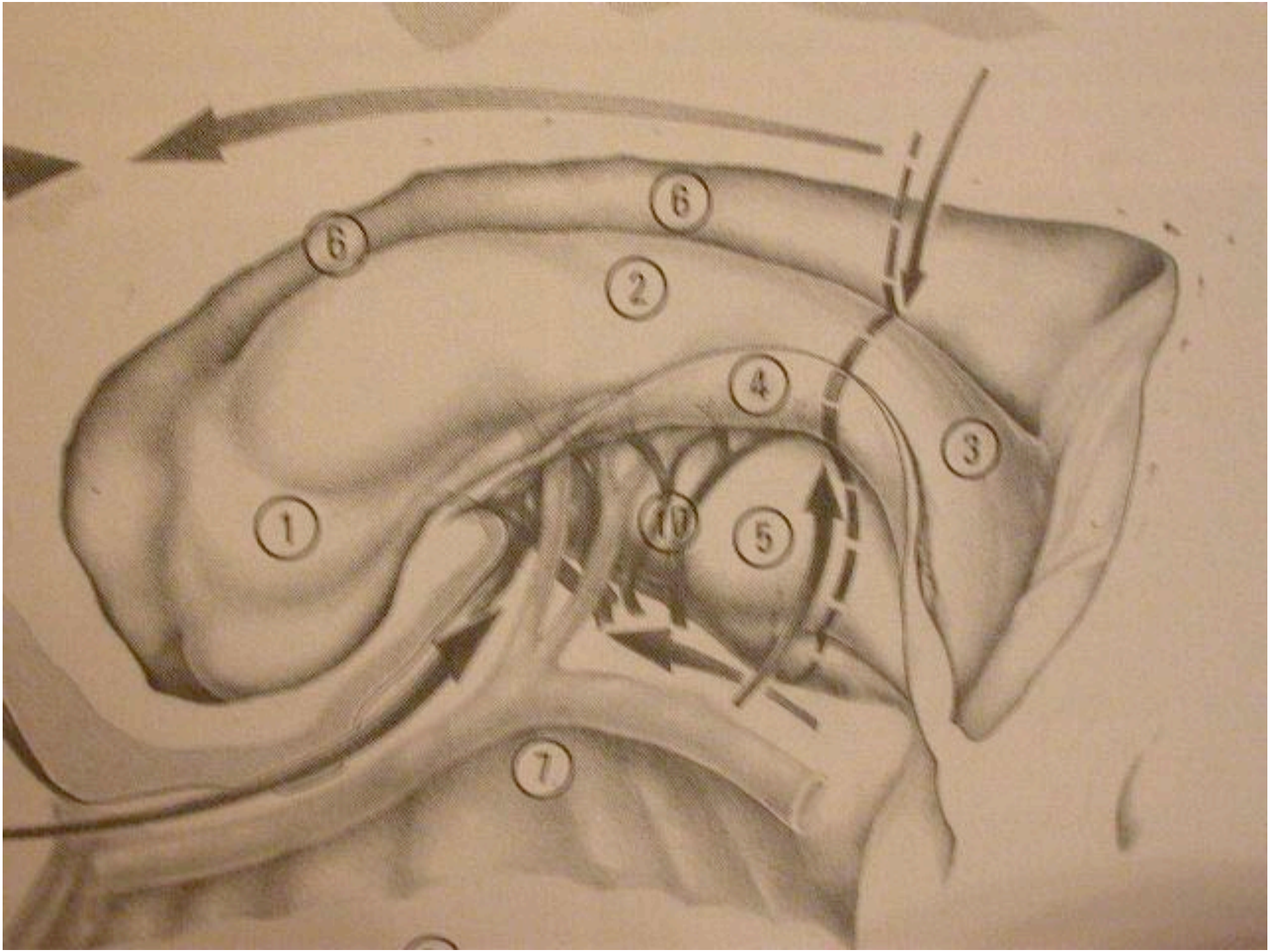
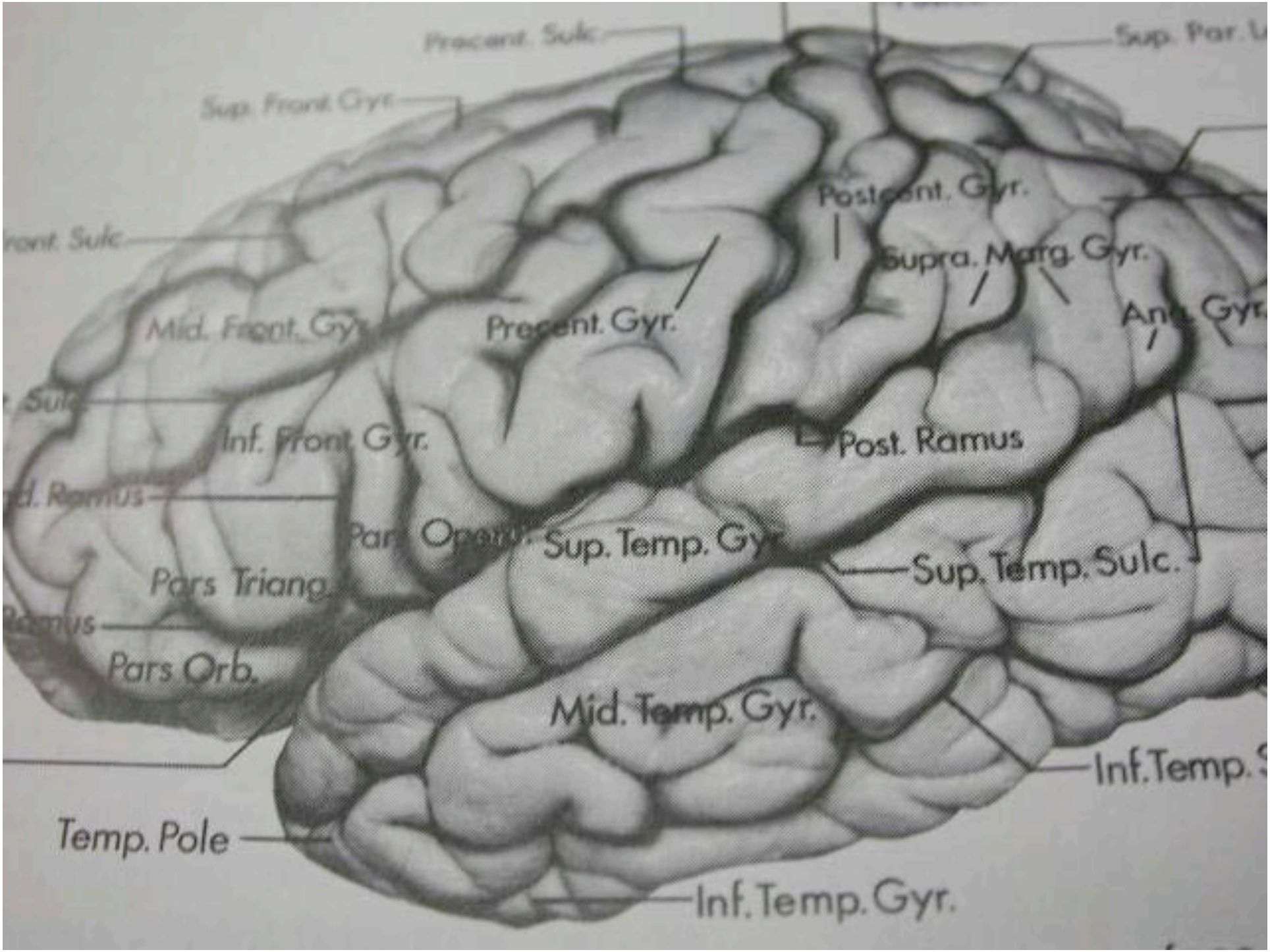


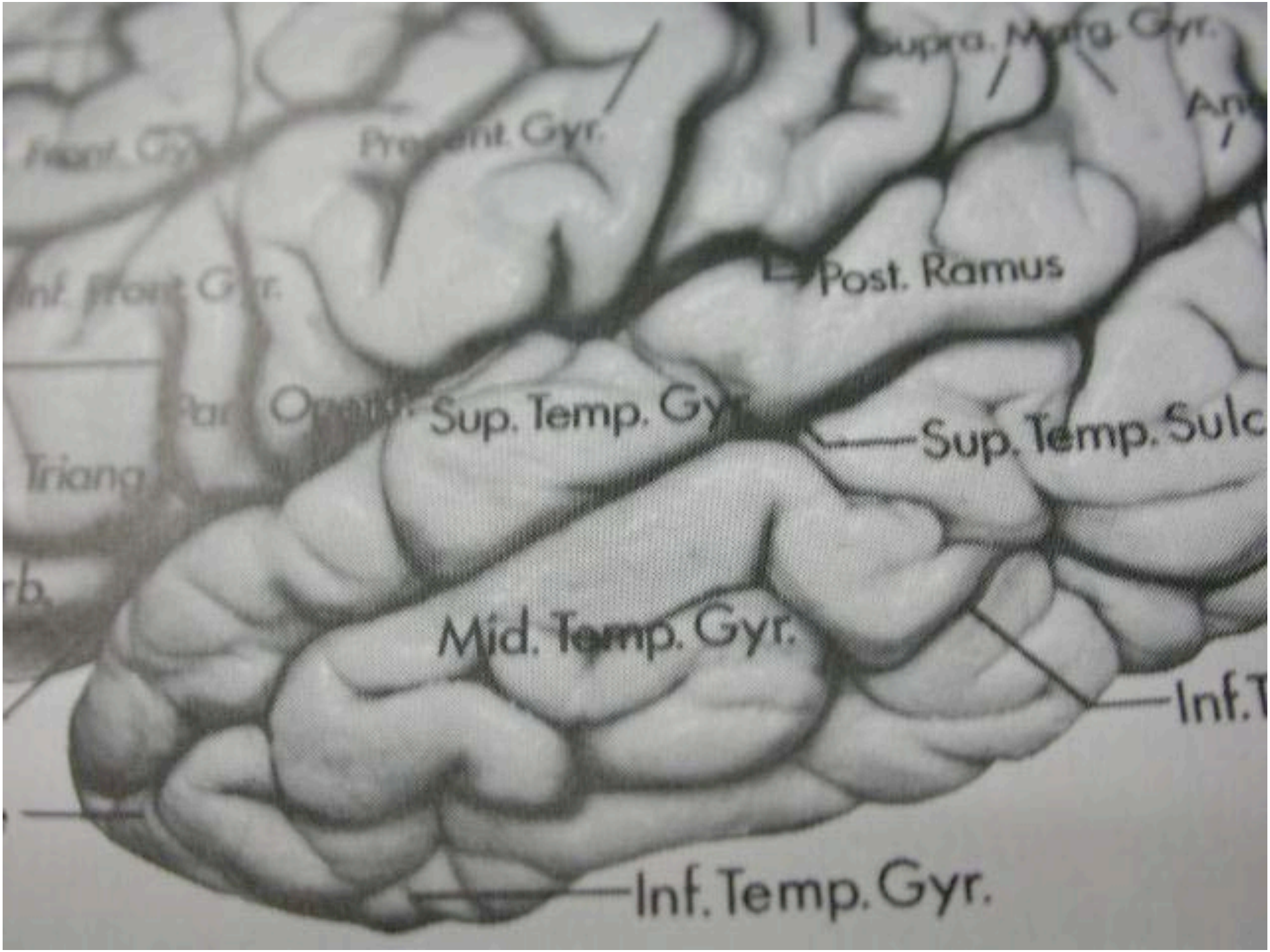
FIG. 2. Schematic drawing showing temporomesial region distances measured on axial sections through 10 adult human cadaver hemispheres. S–V = rhinal sulcus to tip of temporal horn; P–V = temporal pole to tip of temporal horn; P–M = temporal pole to midlevel of brainstem; V–M = tip of temporal horn to midlevel of brainstem. *Shaded area* represents extent of temporomesial en bloc resection.

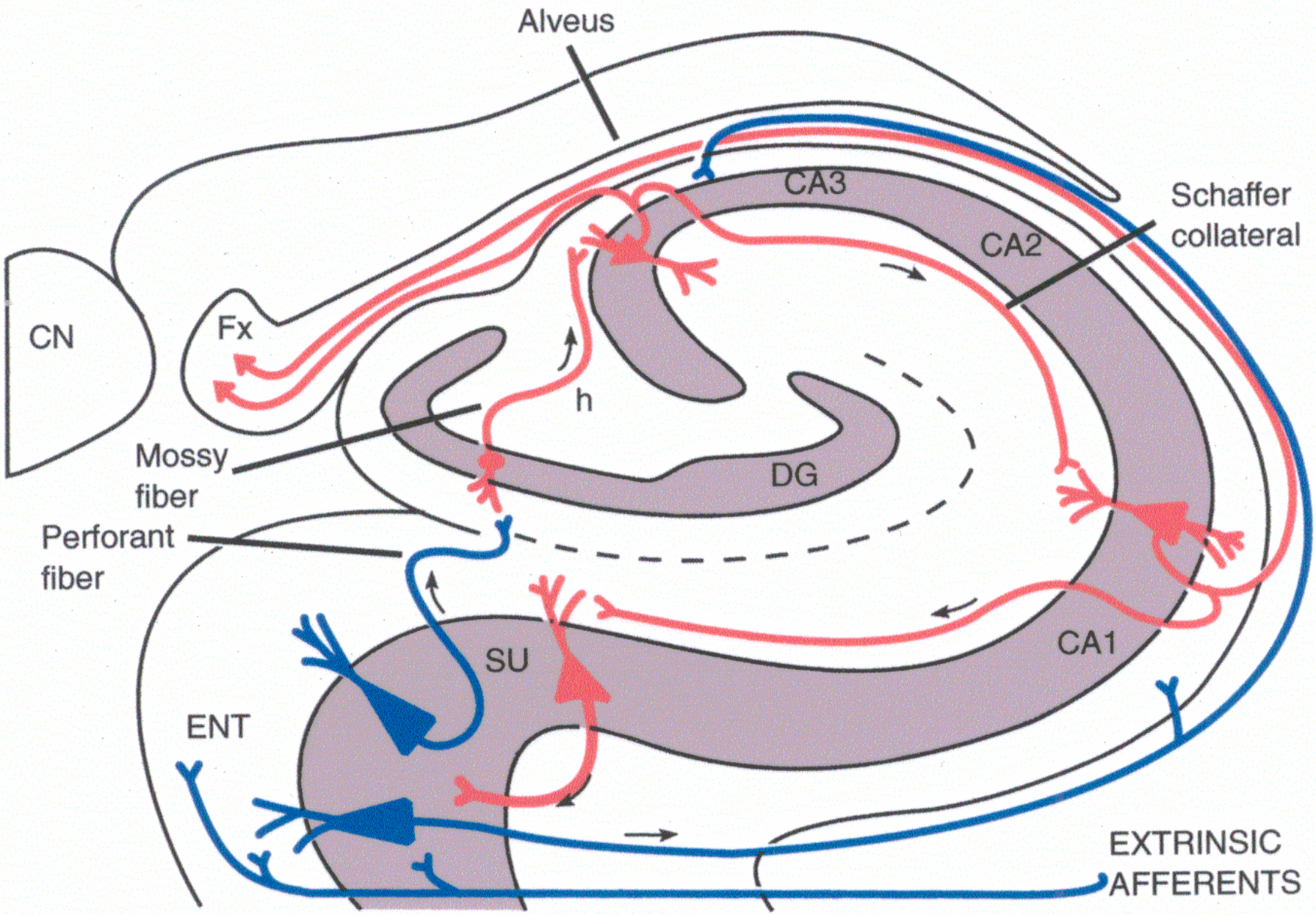

Pu
Pal
T1
A com
5
4
3
1
2
Ot
T2
T3
TCA

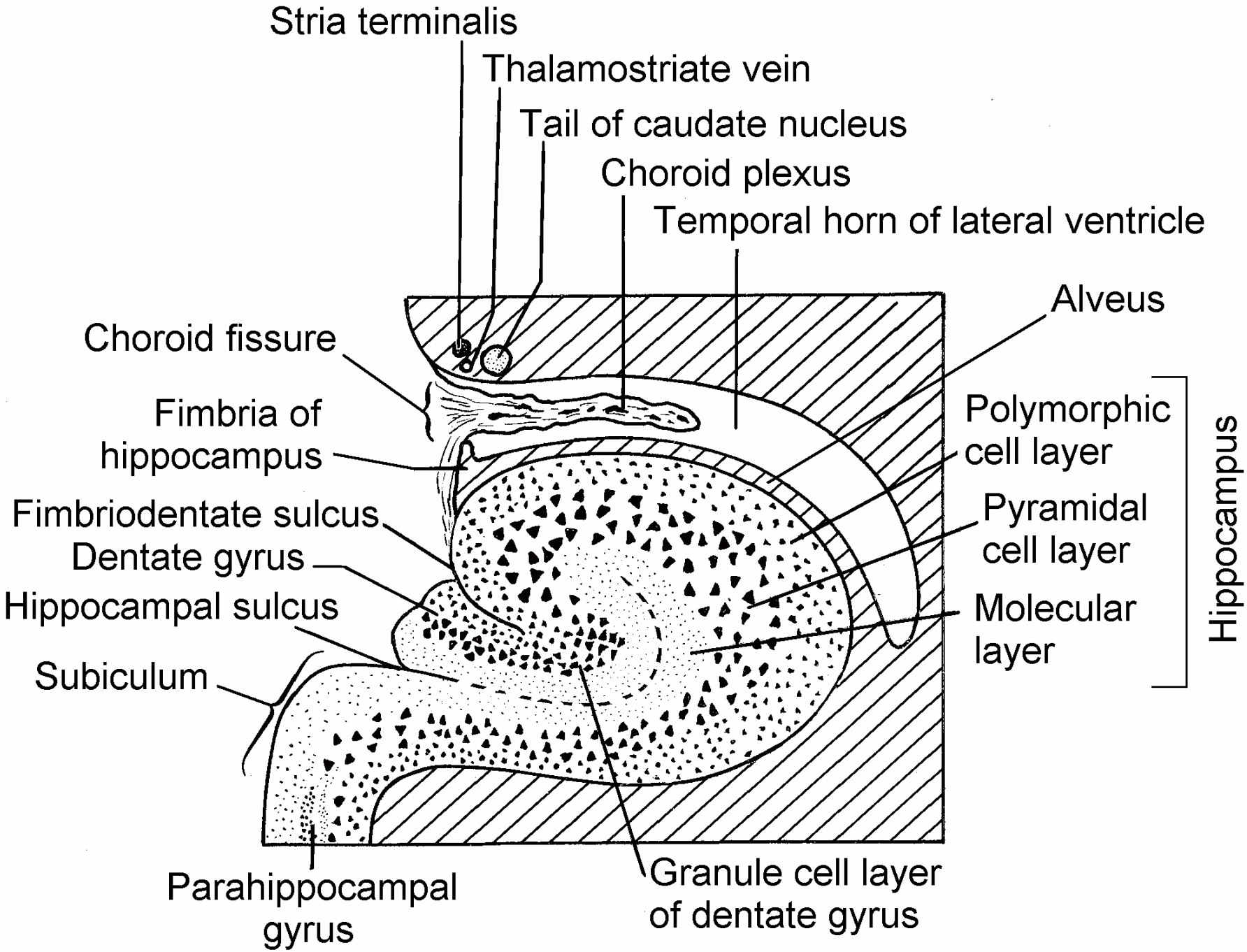

2
3
2'
4
1

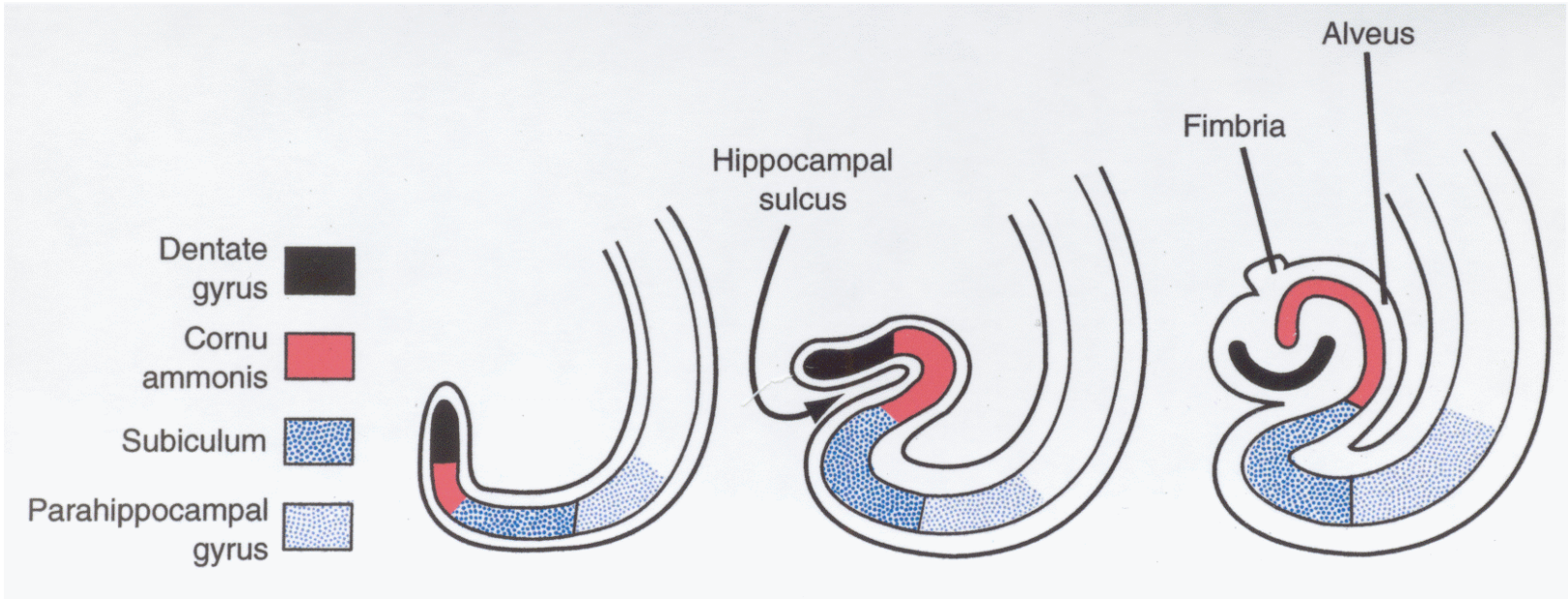

6
6
2
4
3
1
10
5
7

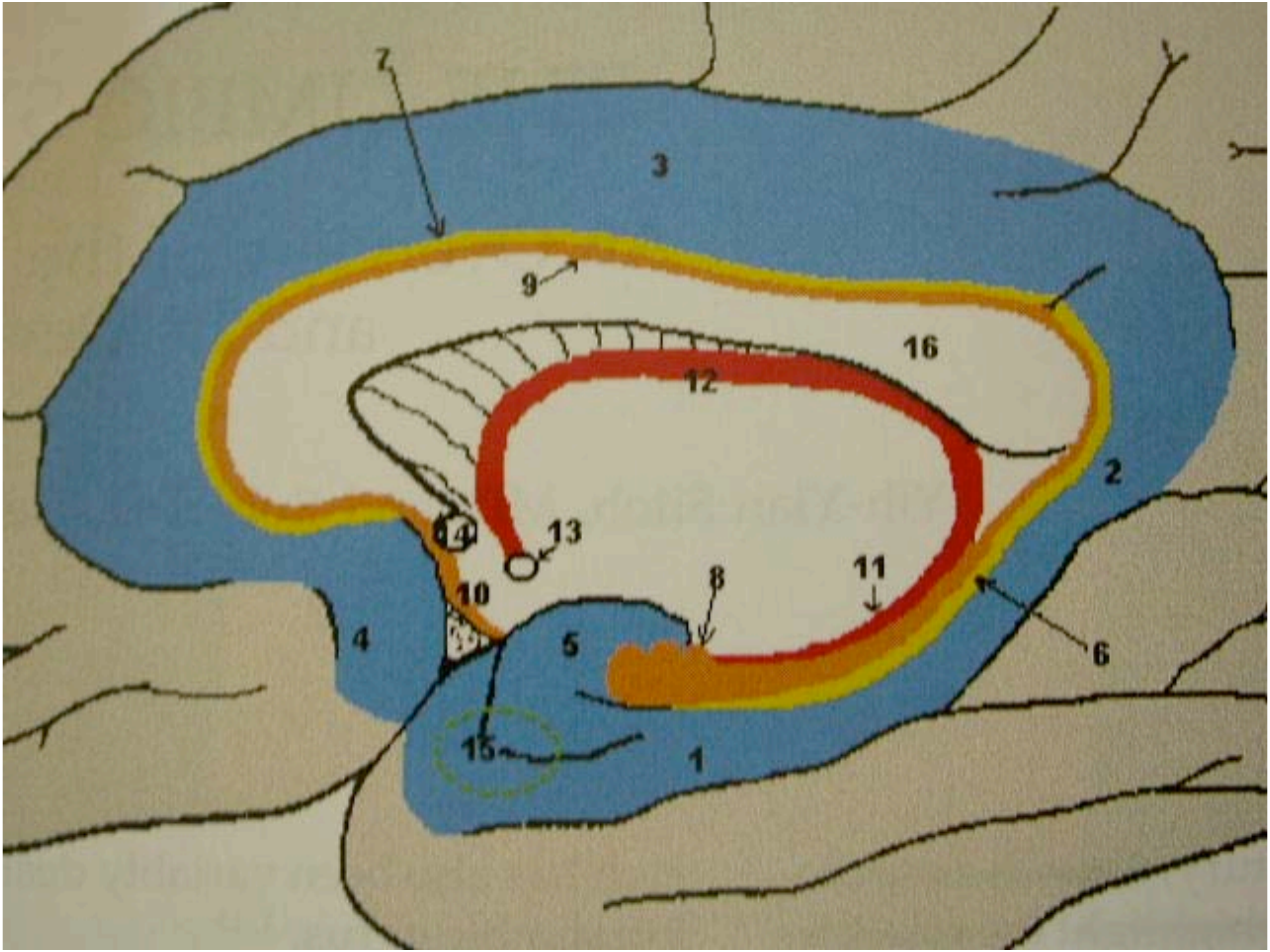

Precent. Sulc.
Sup. Par. L
Sup. Front. Gyr.
Postcent. Gyr.
Supra. Marg. Gyr.
Mid. Front. Gyr.
Precent. Gyr.
Inf. Front. Gyr.
Post. Ramus
Sup. Temp. Gyr.
Sup. Temp. Sulc.
Pars Triang.
Pars Orb.
Mid. Temp. Gyr.
Temp. Pole
Inf. Temp. Gyr.

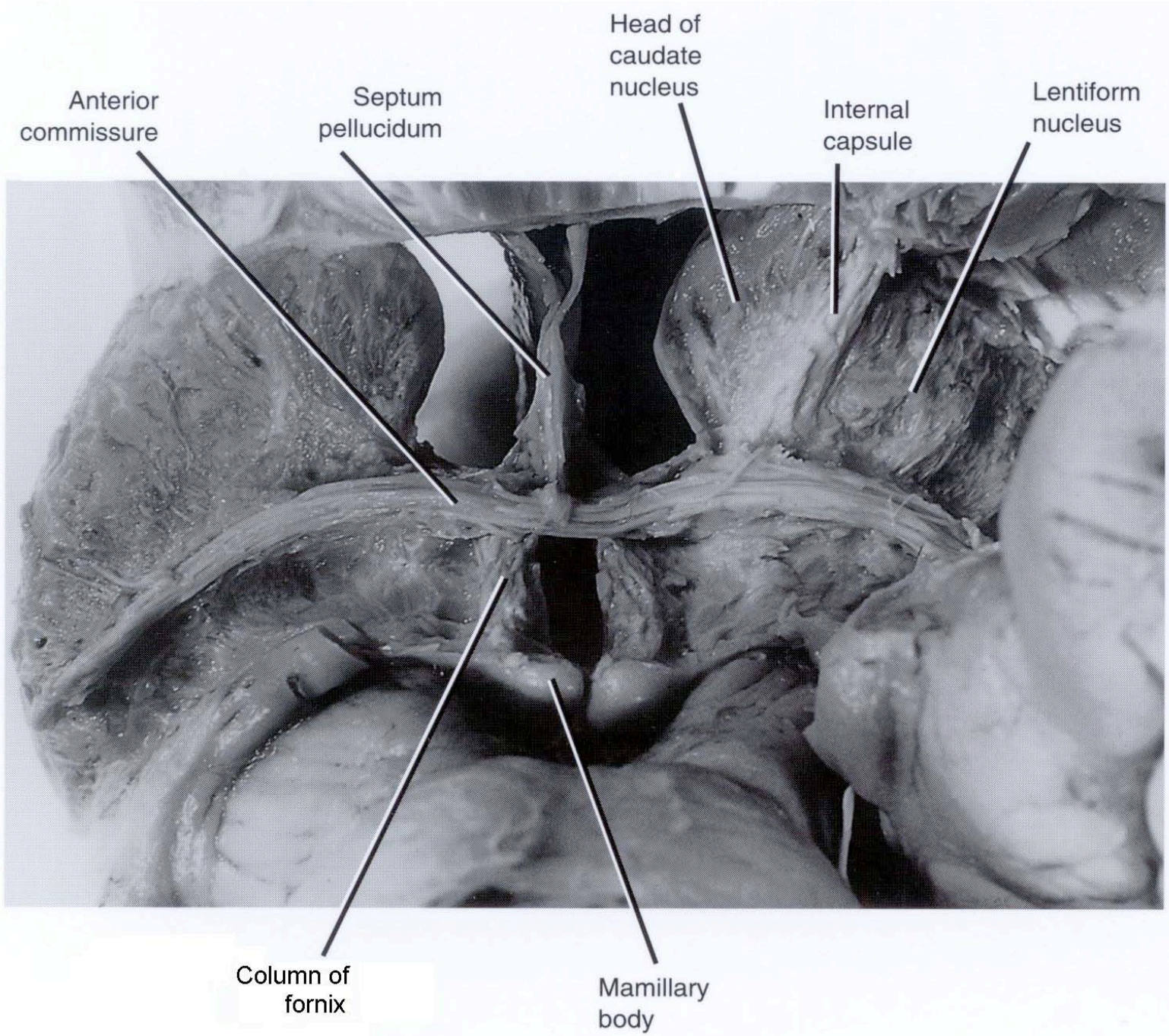

Post. Ramus
Sup. Temp. Gyr.
Sup. Temp. Sulc
Mid. Temp. Gyr.
Inf. Temp. Gyr.


Alveus
CA3
Schaffer
collateral
CA2
CN
Fx
h
Mossy
fiber
DG
Perforant
fiber
SU
CA1
ENT
EXTRINSIC
AFFERENTS


Stria terminalis
Thalamostriate vein
Tail of caudate nucleus
Choroid plexus
Temporal horn of lateral ventricle
Alveus
Choroid fissure
Fimbria of hippocampus
Polymorphic cell layer
Pyramidal cell layer
Molecular layer
Hippocampus
Fimbriodentate sulcus
Dentate gyrus
Hippocampal sulcus
Subiculum
Parahippocampal gyrus
Granule cell layer of dentate gyrus


Dentate gyrus
Cornu ammonis
Subiculum
Parahippocampal gyrus
Hippocampal sulcus
Fimbria
Alveus


7
3
9
16
12
2
14
13
8
11
10
4
5
6
15
1


Anterior commissure
Septum pellucidum
Head of caudate nucleus
Internal capsule
Lentiform nucleus
Column of fornix
Mamillary body