

NEUROANATOMY *for dummies!*

An introduction to gross neuroanatomy

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Health Sciences & Technology



Resources

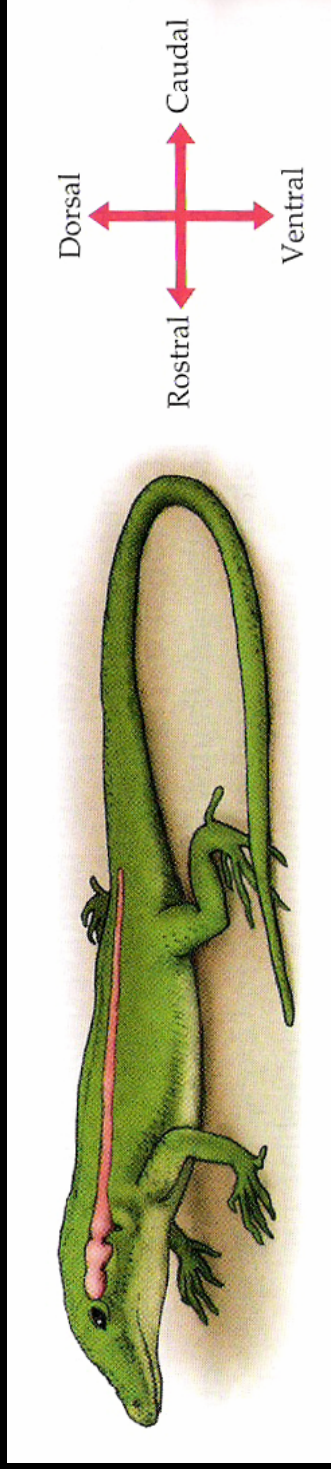
- H. Blumenfeld. Neuroanatomy through clinical cases (Sinauer 2002).
- Digital anatomist:
 - <http://www9.biostr.washington.edu/da.html>
- Sylvius:
 - <http://www.sylvius.com/>

Some slides kindly provided by E. Duerden, UMontreal.

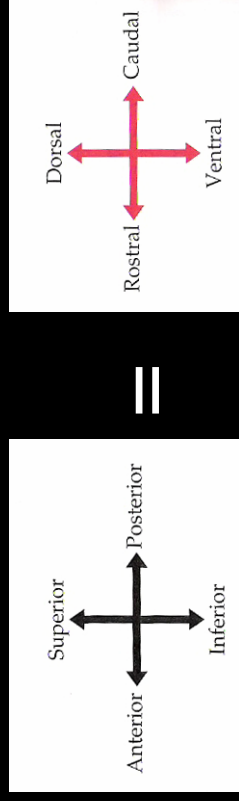
All images and animations included in this presentation are from the Digital Anatomist website, unless otherwise specified.

Orientation

- VENTRAL** = towards the belly (= *ventrum* in latin)
- DORSAL** = towards the back (= *dorsum* in latin)
- ROSTRAL** = towards the snout (*rostrum* = beak in latin)
- CAUDAL** = towards the tail (= *cauda* in latin)

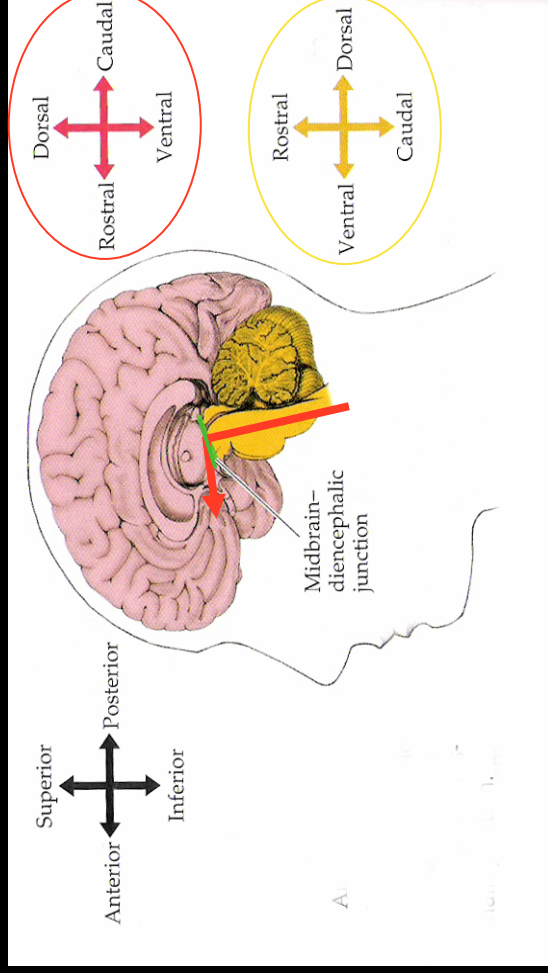
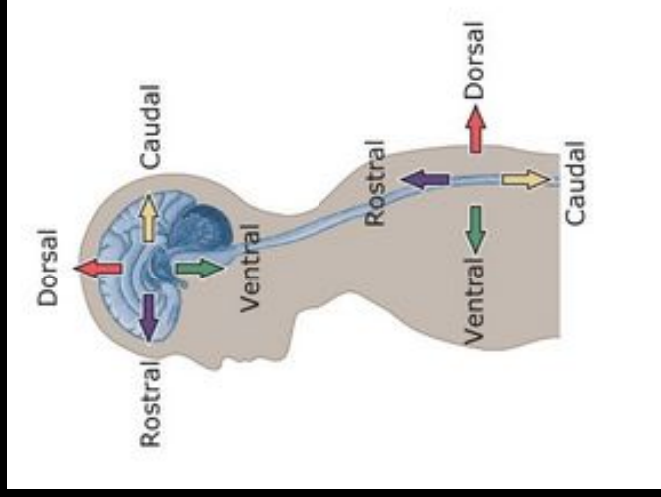


In animals with a linear organization of the CNS, terminology is straightforward:



Orientation

Humans, however, have an upright posture...



ABOVE
M-D junction

BELOW
M-D junction

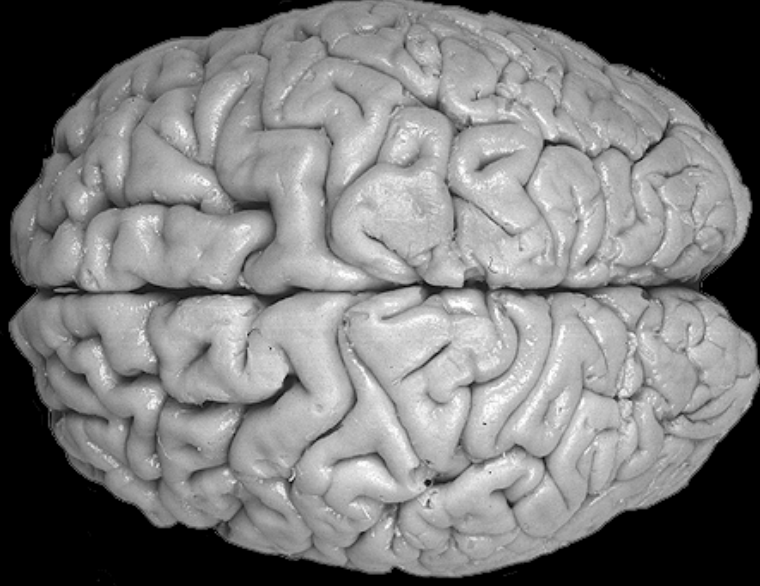
Watch out! 'Superior'='Dorsal' above the midbrain; ='Rostral' in the midbrain or below

Orientation

MEDIAL = close to the midline

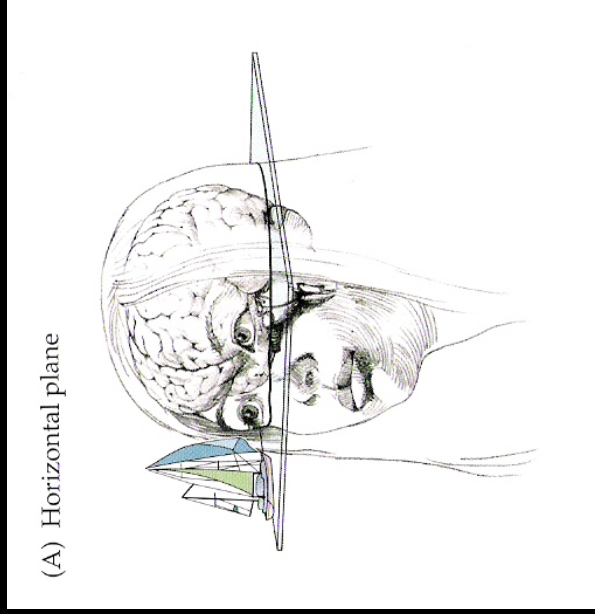
LATERAL = close to the sides

LATERAL ← MEDIAL → LATERAL



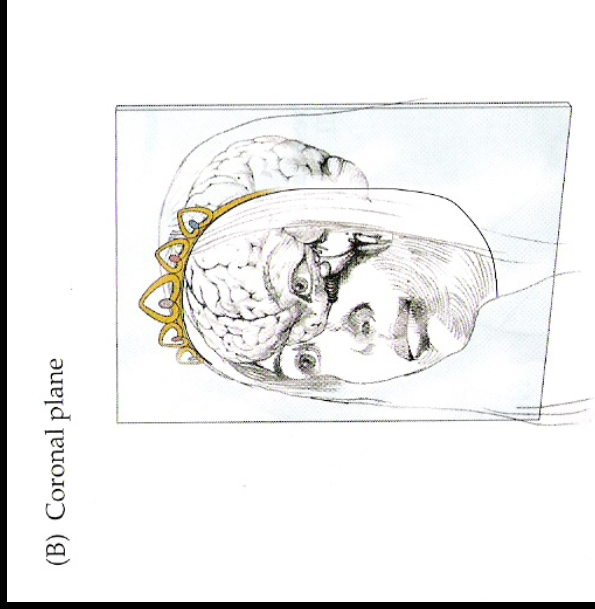
Orientation

Horizontal (axial/transverse)



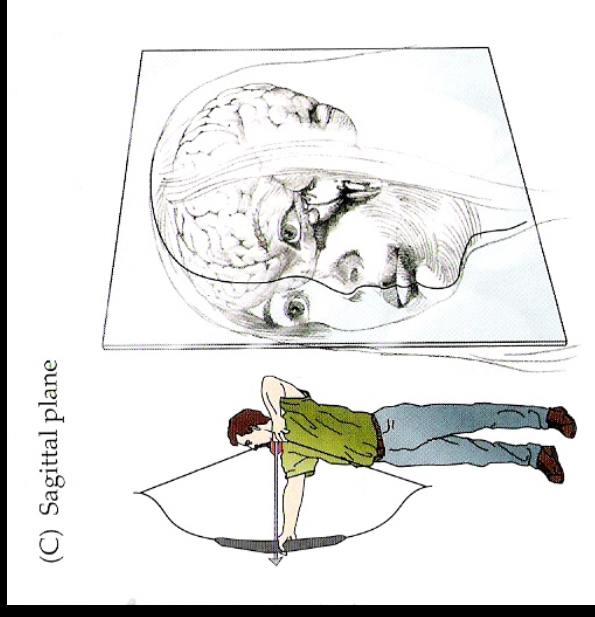
Think about the horizon!

Coronal



Imagine a tiara-like crown!

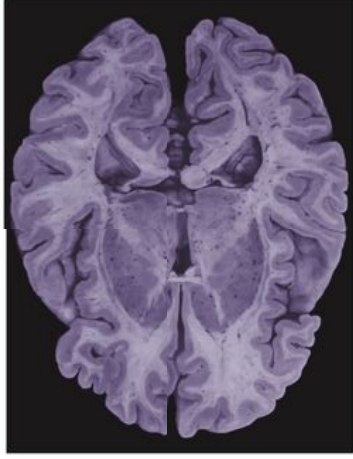
Sagittal



Think about the bow of an archer!

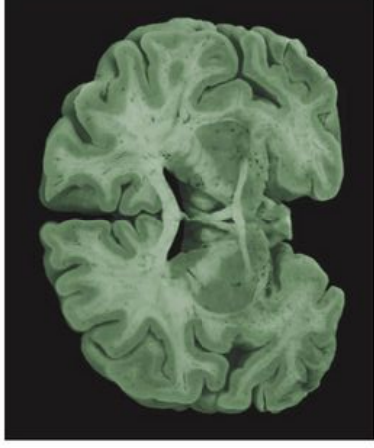
Orientation

Horizontal (axial/transverse)



Think about the horizon!

Coronal



Imagine a tiara-like crown!

Sagittal



Think about the bow of an archer!

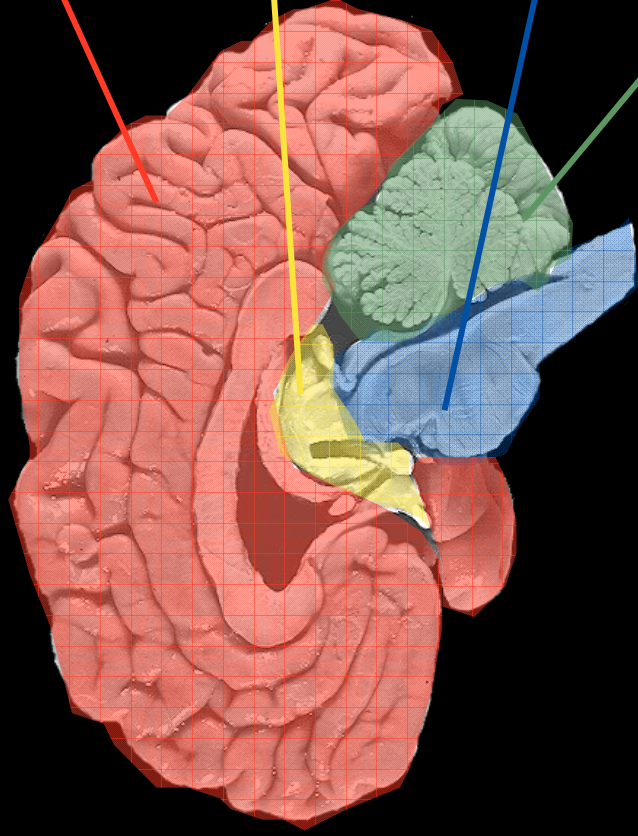
Major subdivisions of the encephalon

Telencephalon
-Cereb. Hemispheres
(including cortex and
subcortical structures)

Diencephalon
-thalamus
-hypothalamus
-other associated structures

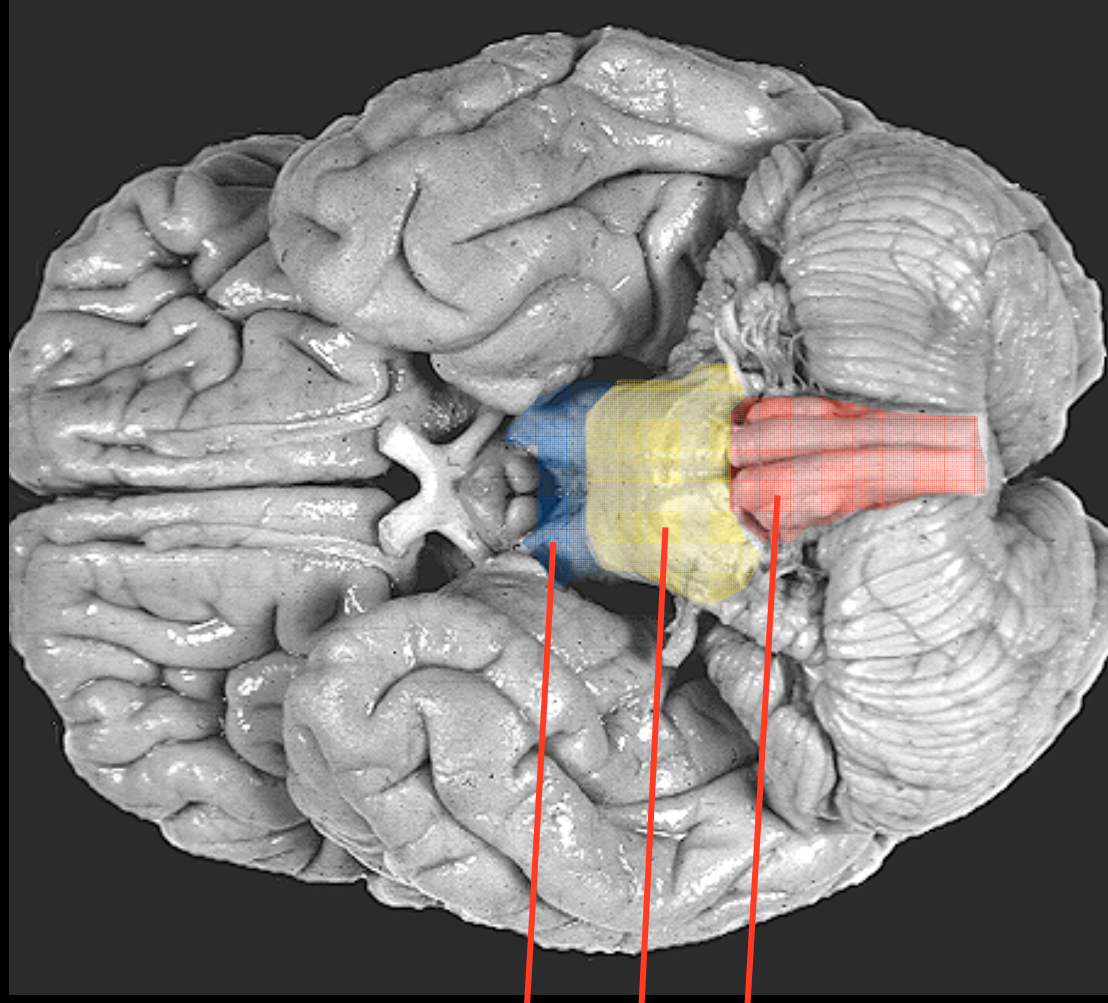
Brainstem
-Midbrain (mesencephalon)
-Pons*
-Medulla oblongata (myelencephalon)

Cerebellum*



* Pons+cerebellum = metencephalon

The brainstem

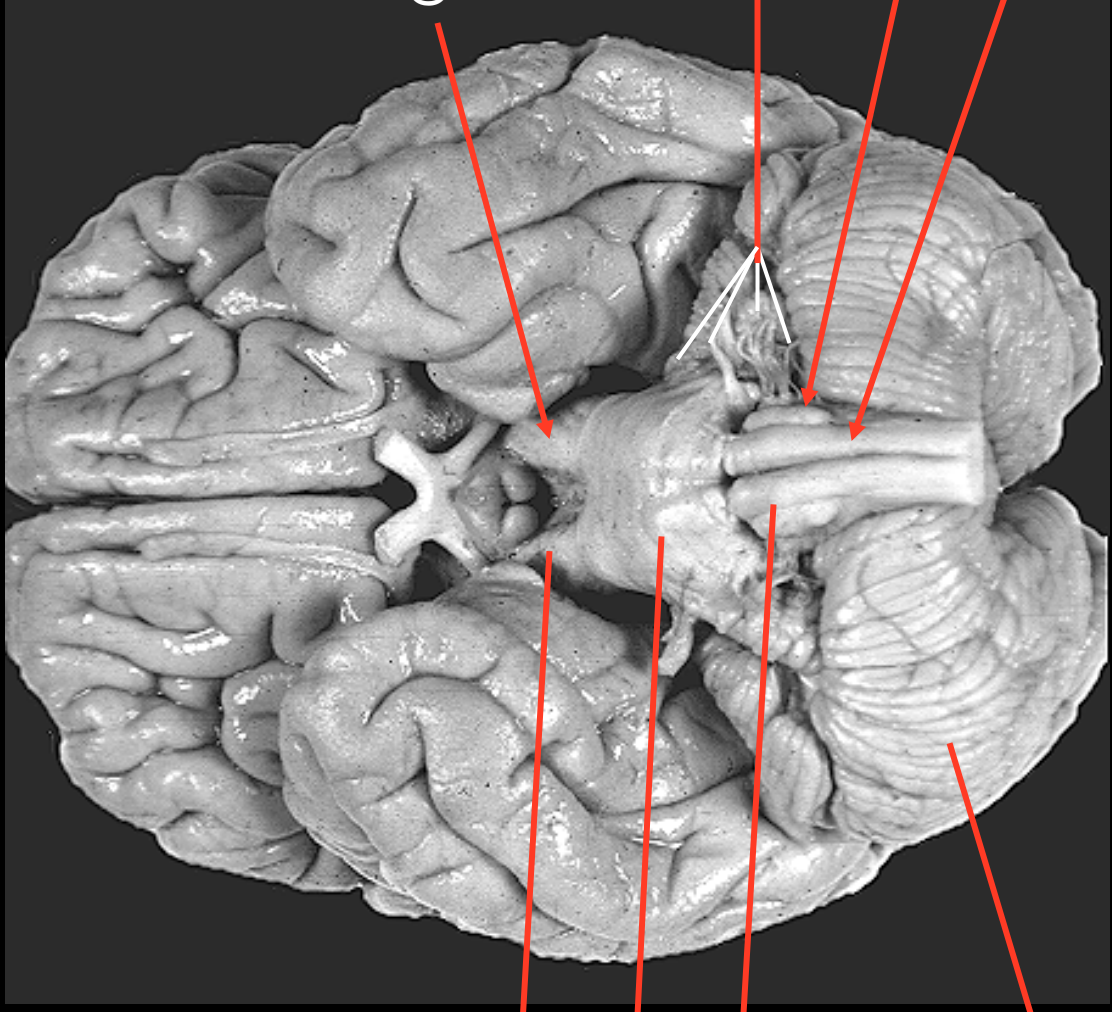


Midbrain

Pons

Medulla Oblongata

The brainstem



Cerebral peduncles

Cranial nerves

Inferior Olives

Pyramids

Midbrain

Pons

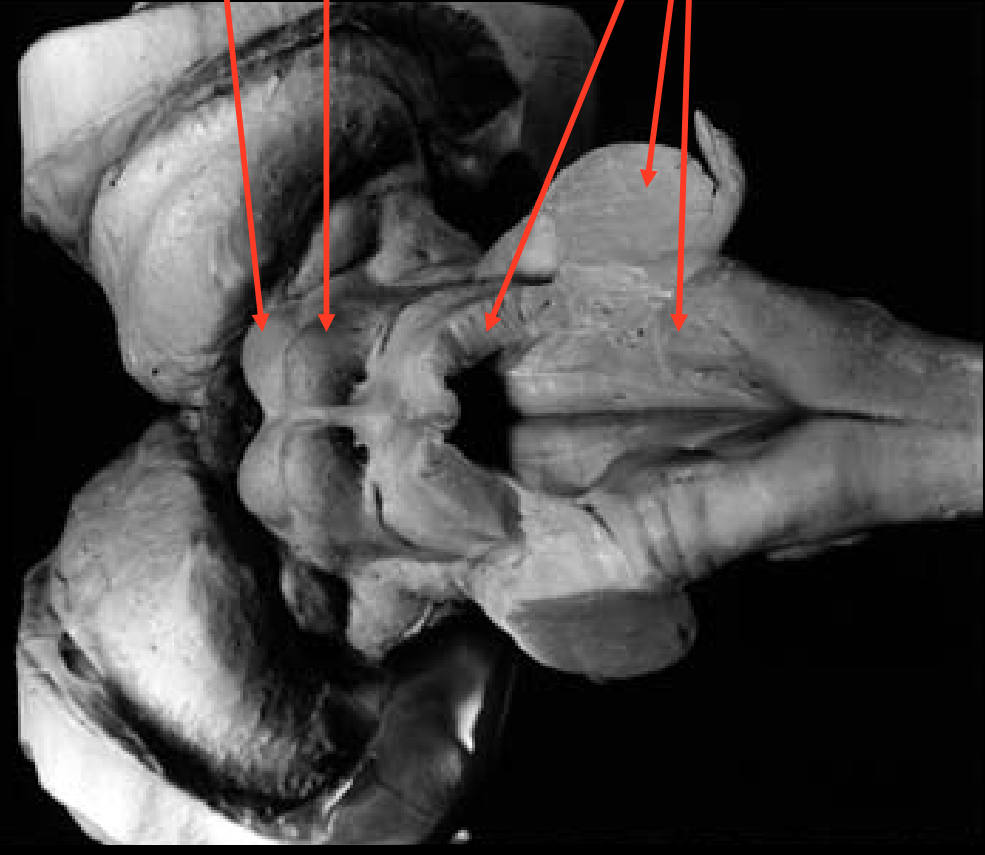
Medulla Oblongata

Cerebellum

The brainstem



The brainstem



Midbrain

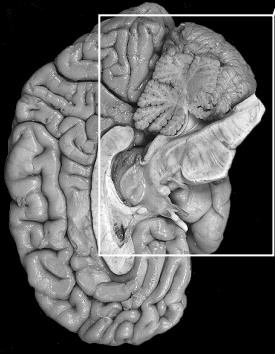


Pons



Medulla
Oblongata

The brainstem



Midbrain

Pons

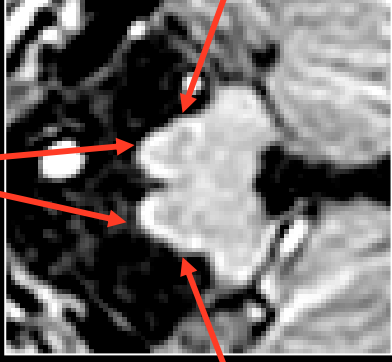
Medulla Oblongata

Cerebellum

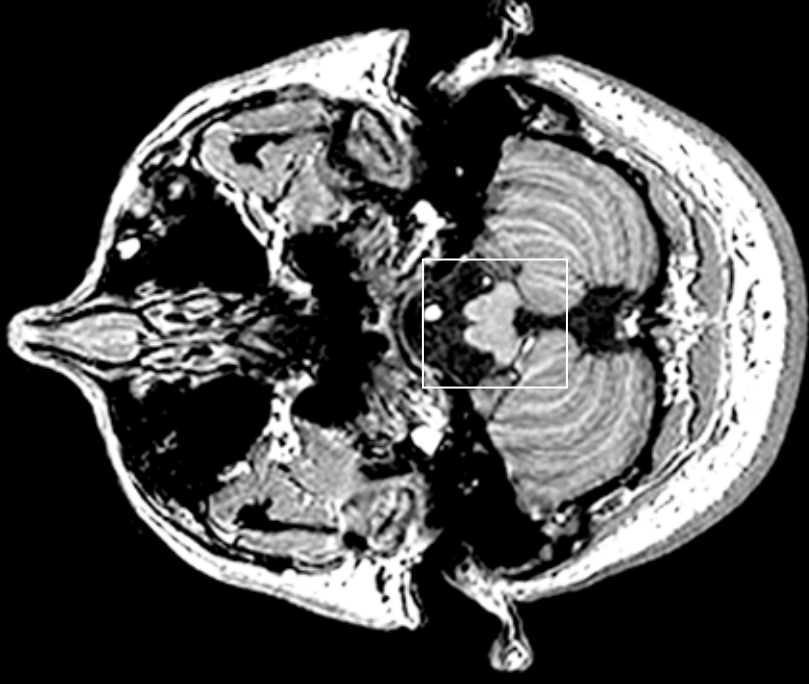
The brainstem

Tips to find **the medulla** on axial slices:

I can see two ventral 'bumps' (PYRAMIDS)



Lateral to these,
two more subtle 'bumps'
(INF. OLIVES)

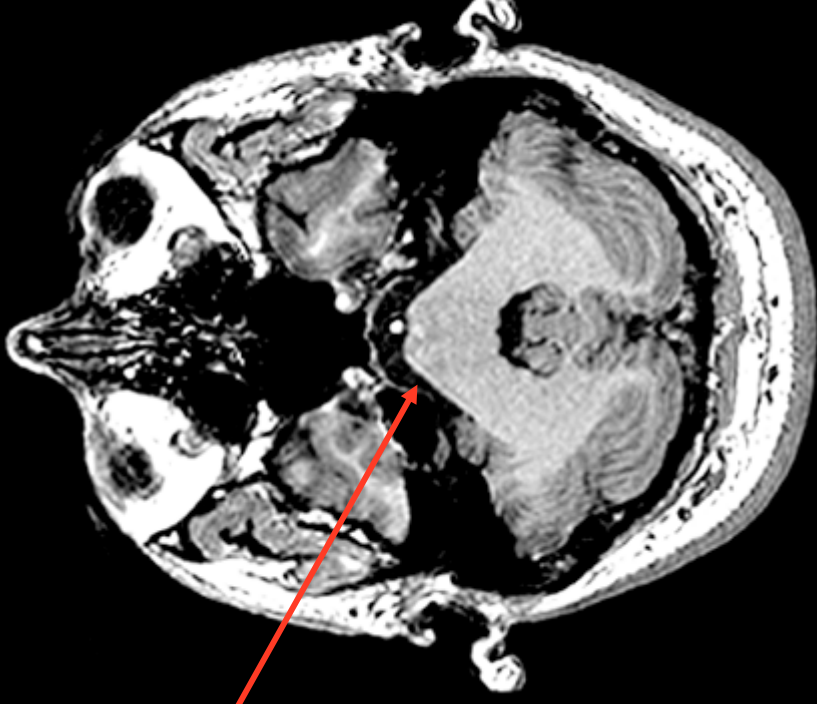


I am the level of the MEDULLA!

The brainstem

Tips to find **the pons** on axial slices:

I can see the large 'belly'

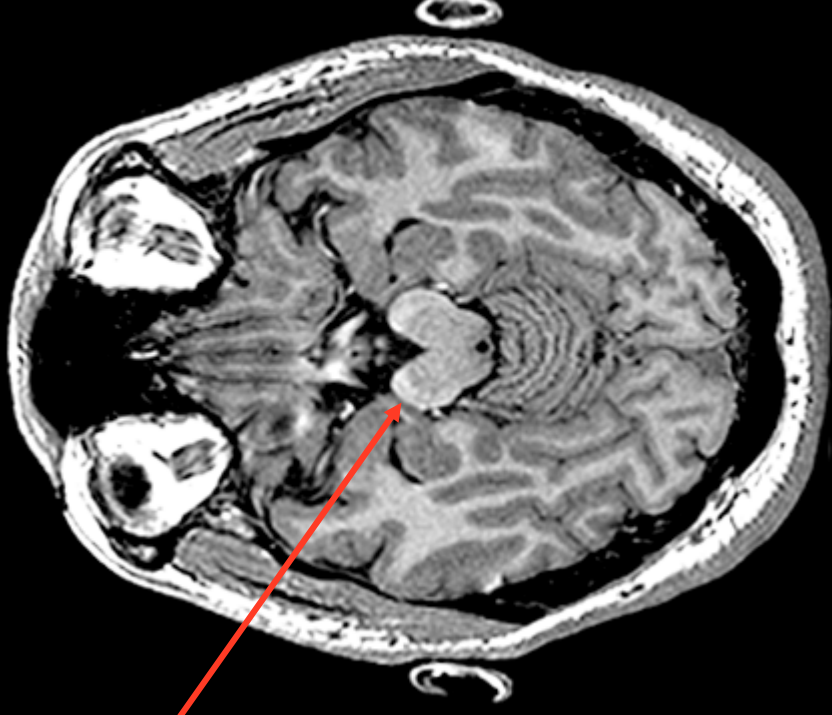


I am the level of the **PONS!**

The brainstem

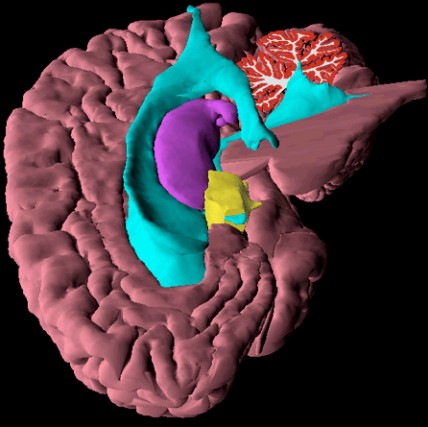
Tips to find **the midbrain** on axial slices:

I see **MICKEY!**
(the ears=cerebral peduncles)



I am the level of the MIDBRAIN!

The diencephalon



Hypothalamic sulcus

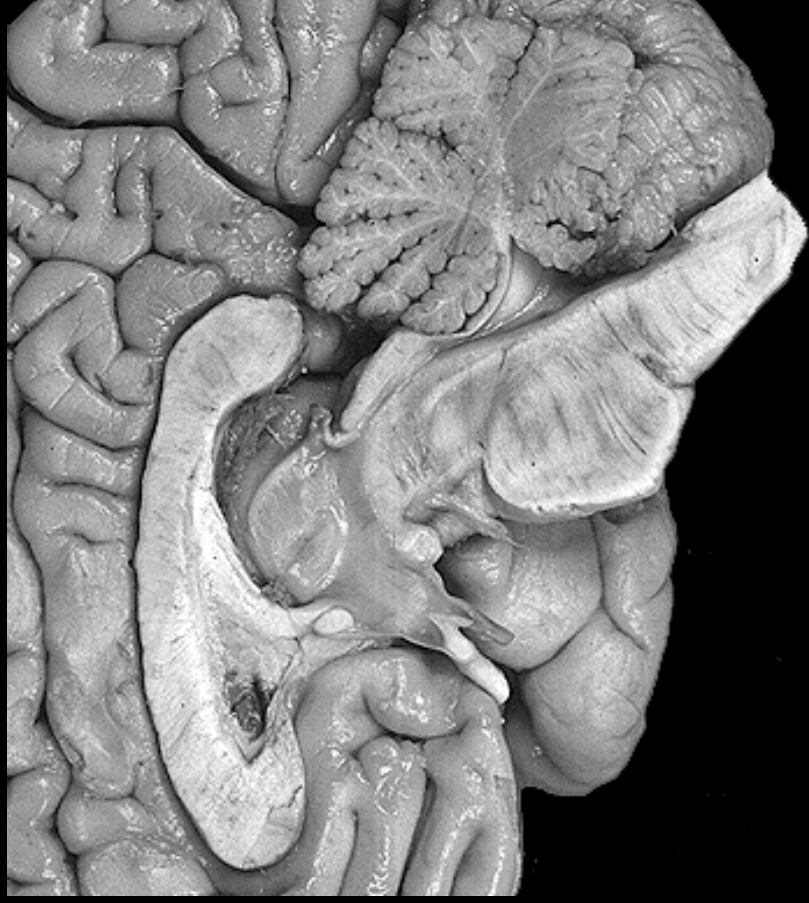


Thalamus

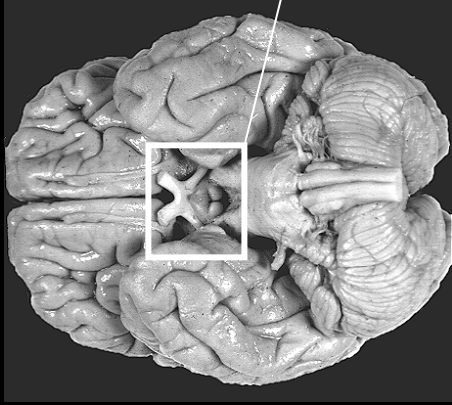
Hypothalamus

The diencephalon

The ICECREAM tip: Thalamus is the SCOOP, the hypothalamus the CONE!



The diencephalon

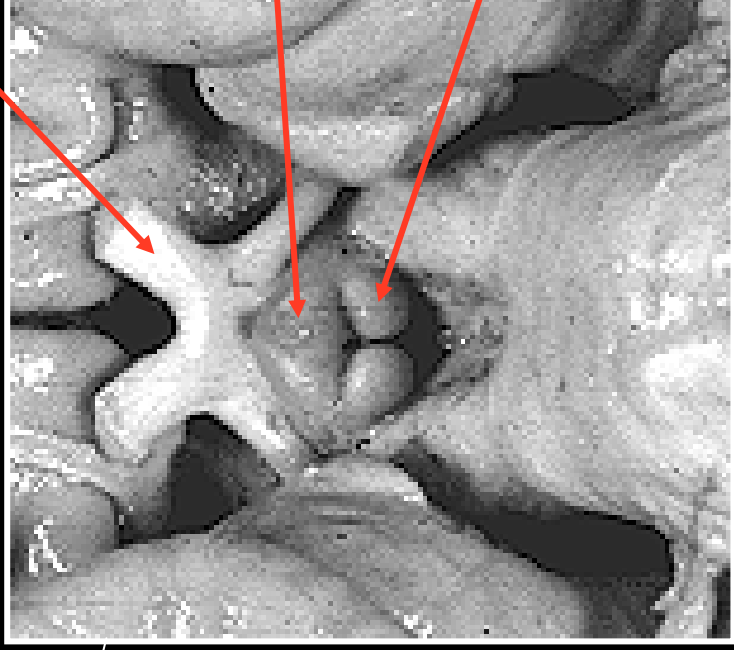


Hypothalamus lies dorsal to these structures

Optic chiasm

Infundibulum of the Pituitary gland

Mammillary bodies

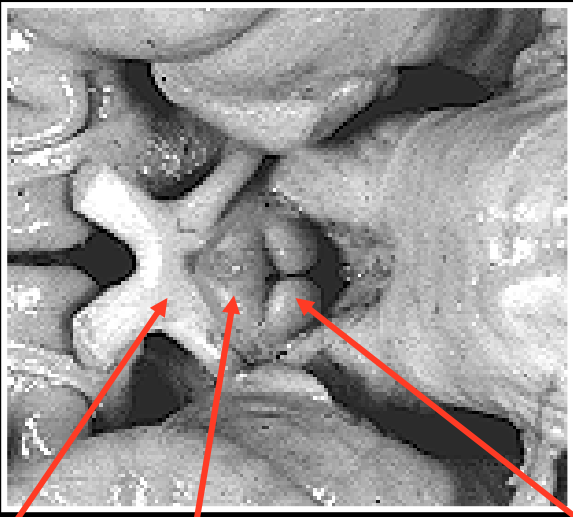


The diencephalon

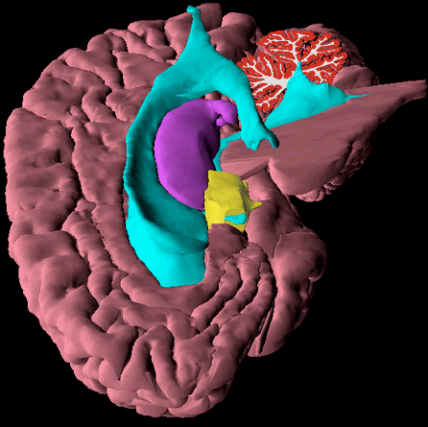
Optic chiasm

Infundibulum of the pituitary gland

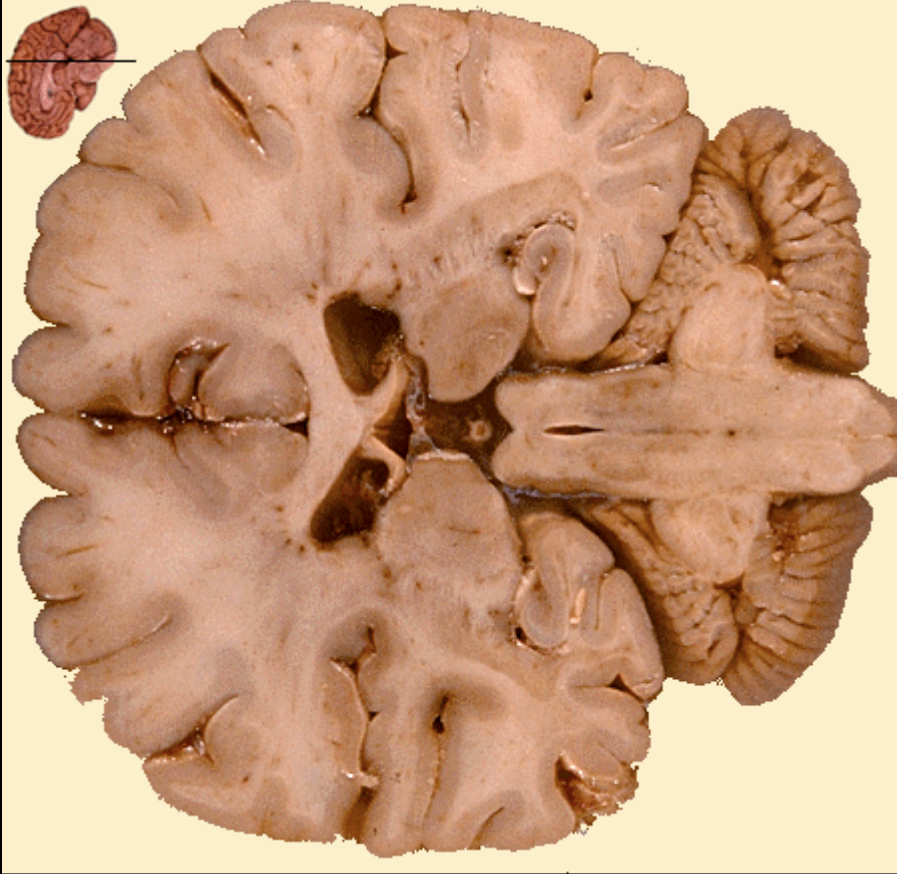
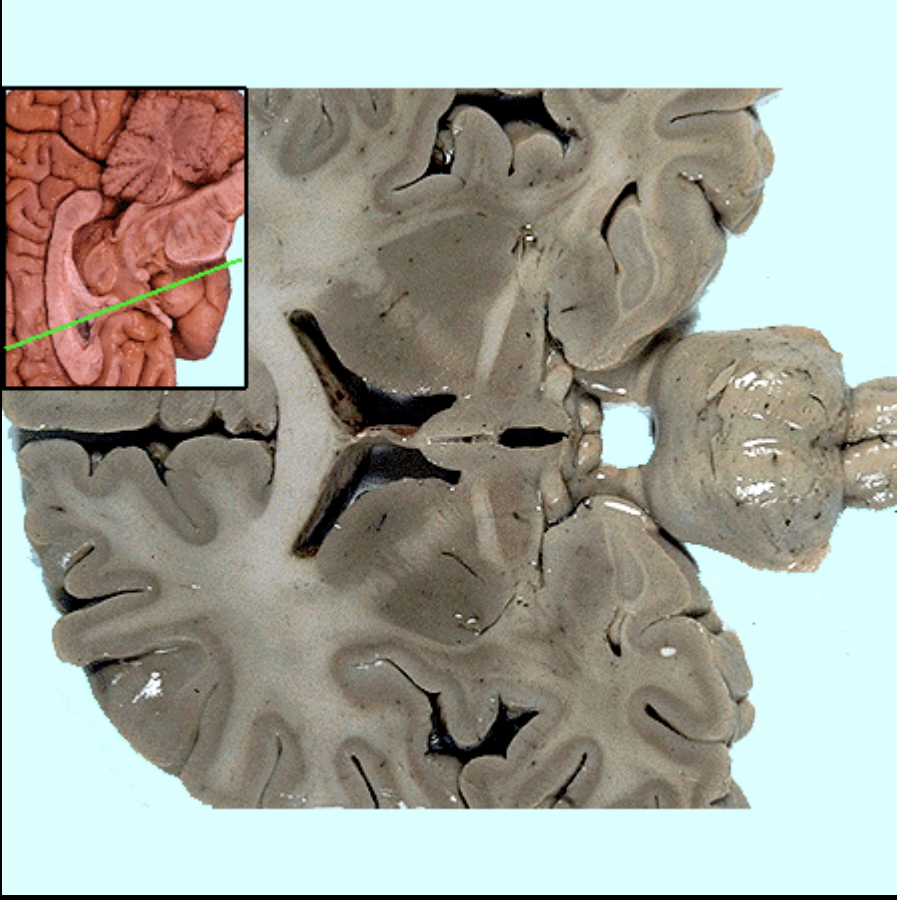
Mammillary bodies



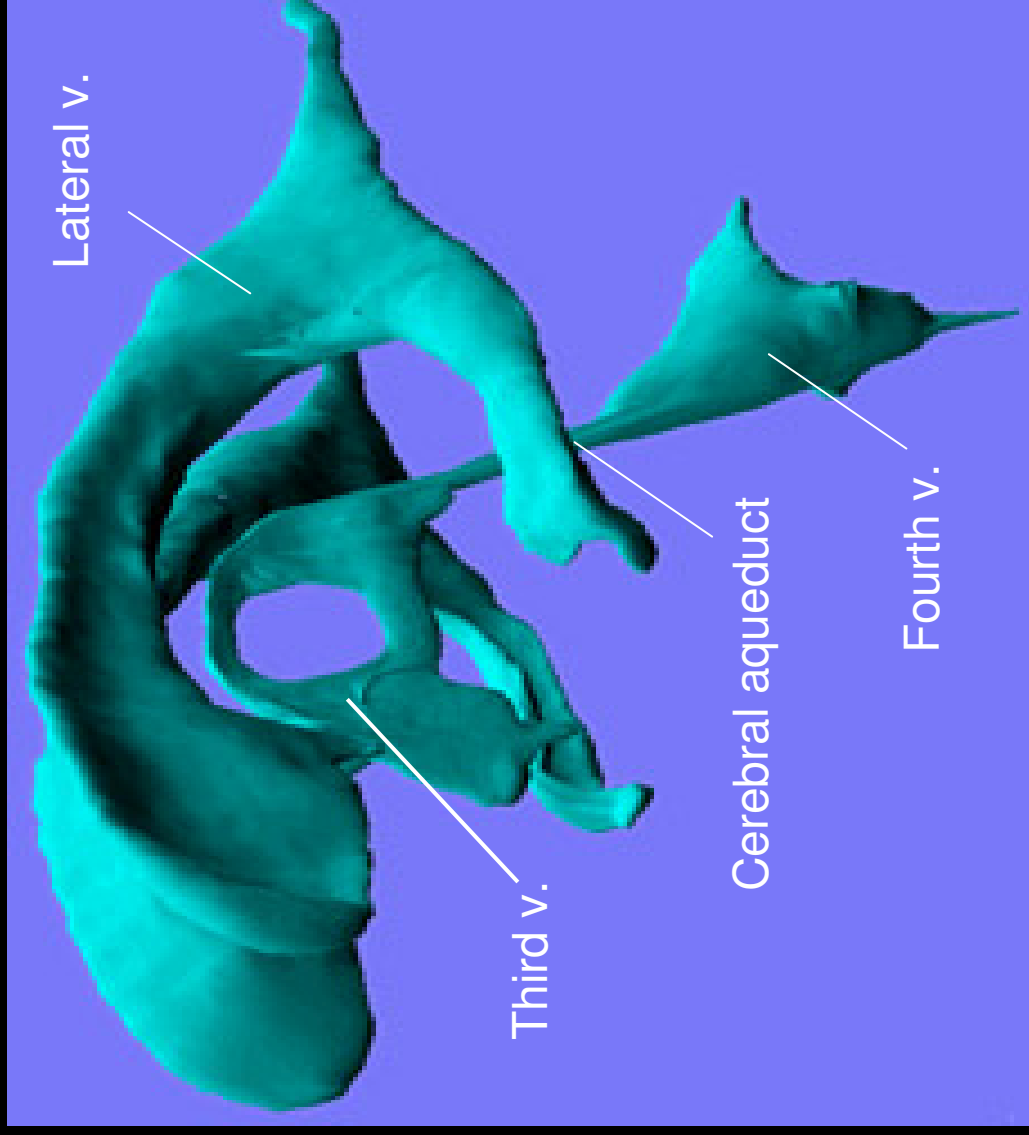
The diencephalon



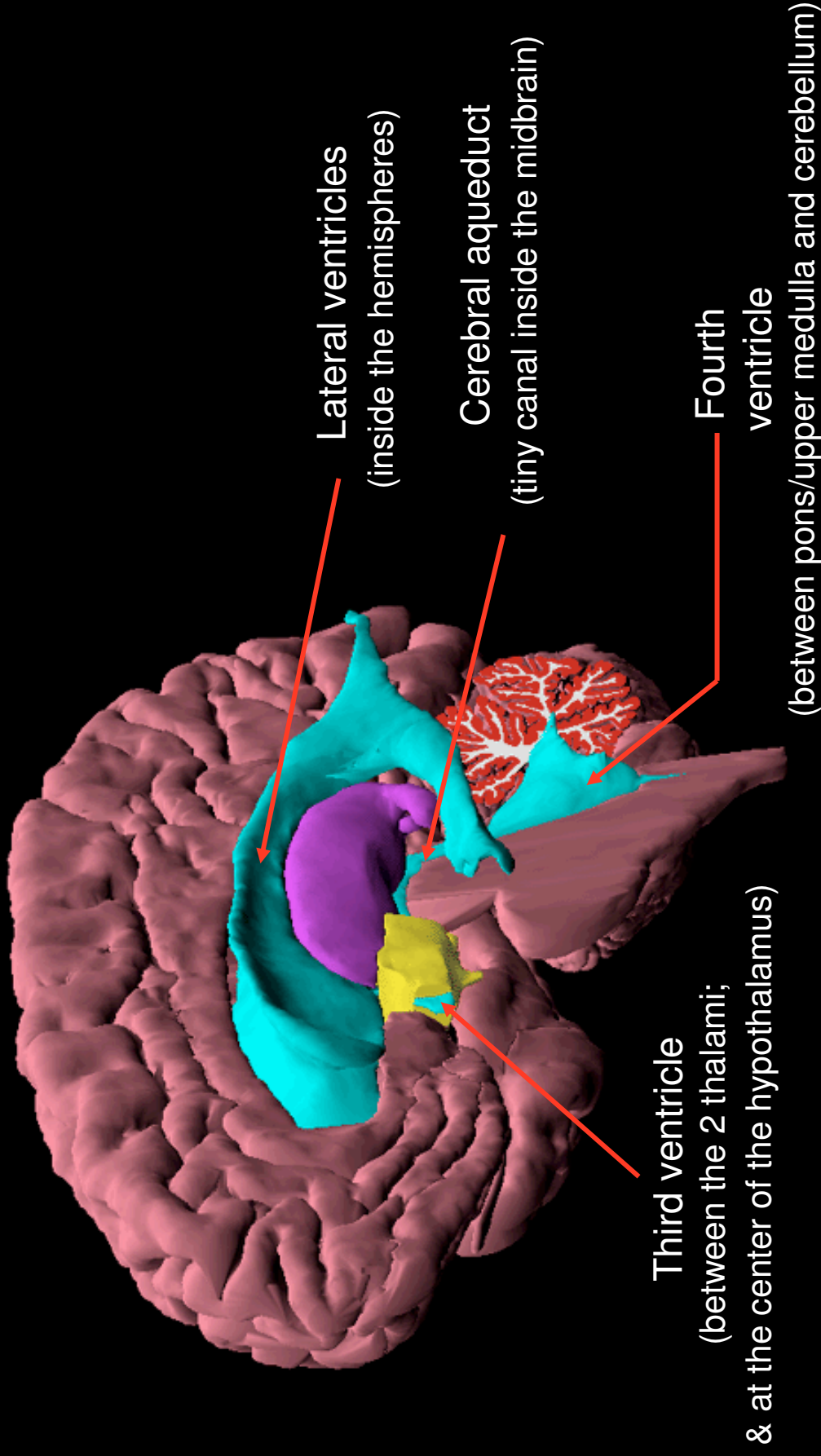
The diencephalon



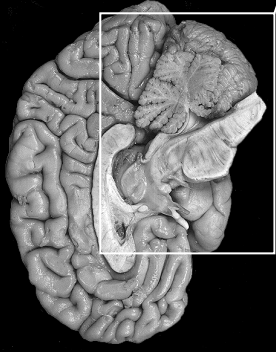
The ventricular system



The ventricular system



The ventricular system



Foramen of Monro Third ventricle

Cerebral aqueduct

Fourth ventricle



Thalamus

Hypothalamus

Midbrain

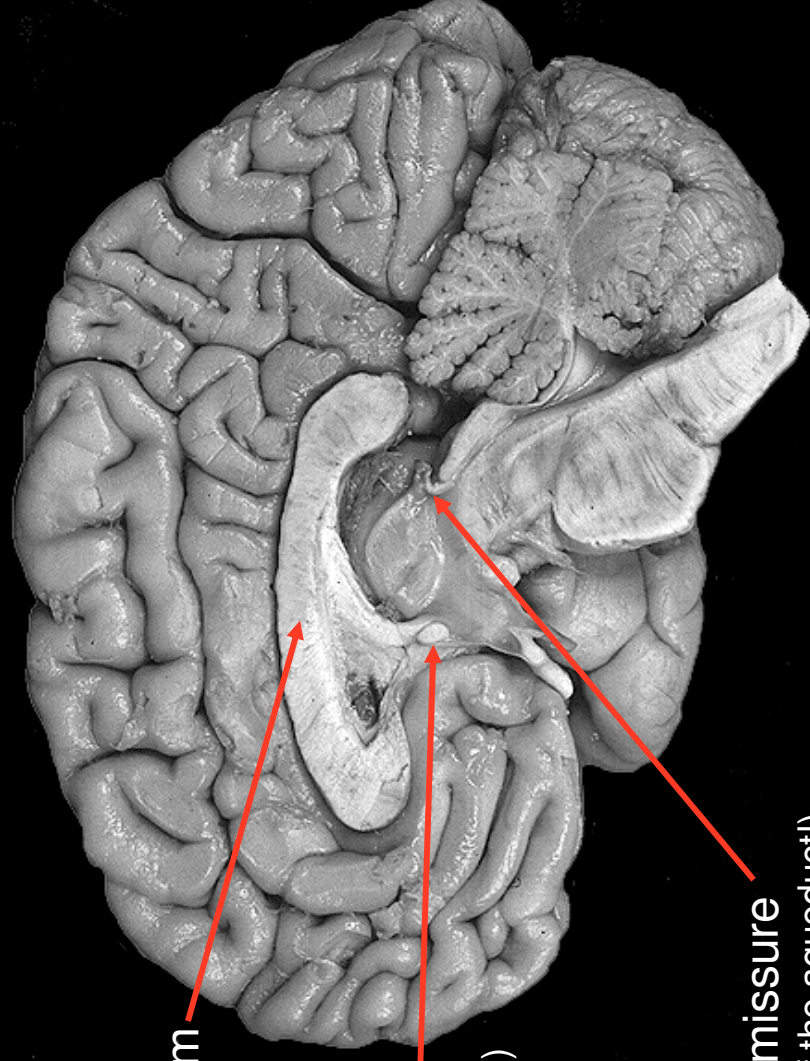
Pons

Medulla Oblongata

Cerebellum

Cerebral Hemispheres

- 2 hemispheres, interconnected by: corpus callosum, anterior commissure, posterior commissure and (in some individuals) interthalamic adhesion (aka massa intermedia).



Corpus callosum

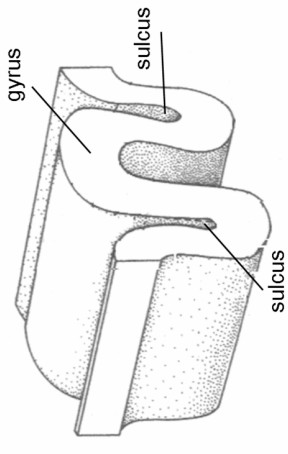
Anterior
Commissure
(tip: rostral to the fornix!)

Posterior commissure
(tip: rostral to the top of the aqueduct!)

Cerebral Hemispheres

- 2 hemispheres, interconnected by: corpus callosum, anterior commissure, posterior commissure and (in some individuals) interthalamic adhesion.
- In each hemisphere: cortex (gyri, sulci), white matter and subcortical structures (including hippocampus, amygdala and basal ganglia).

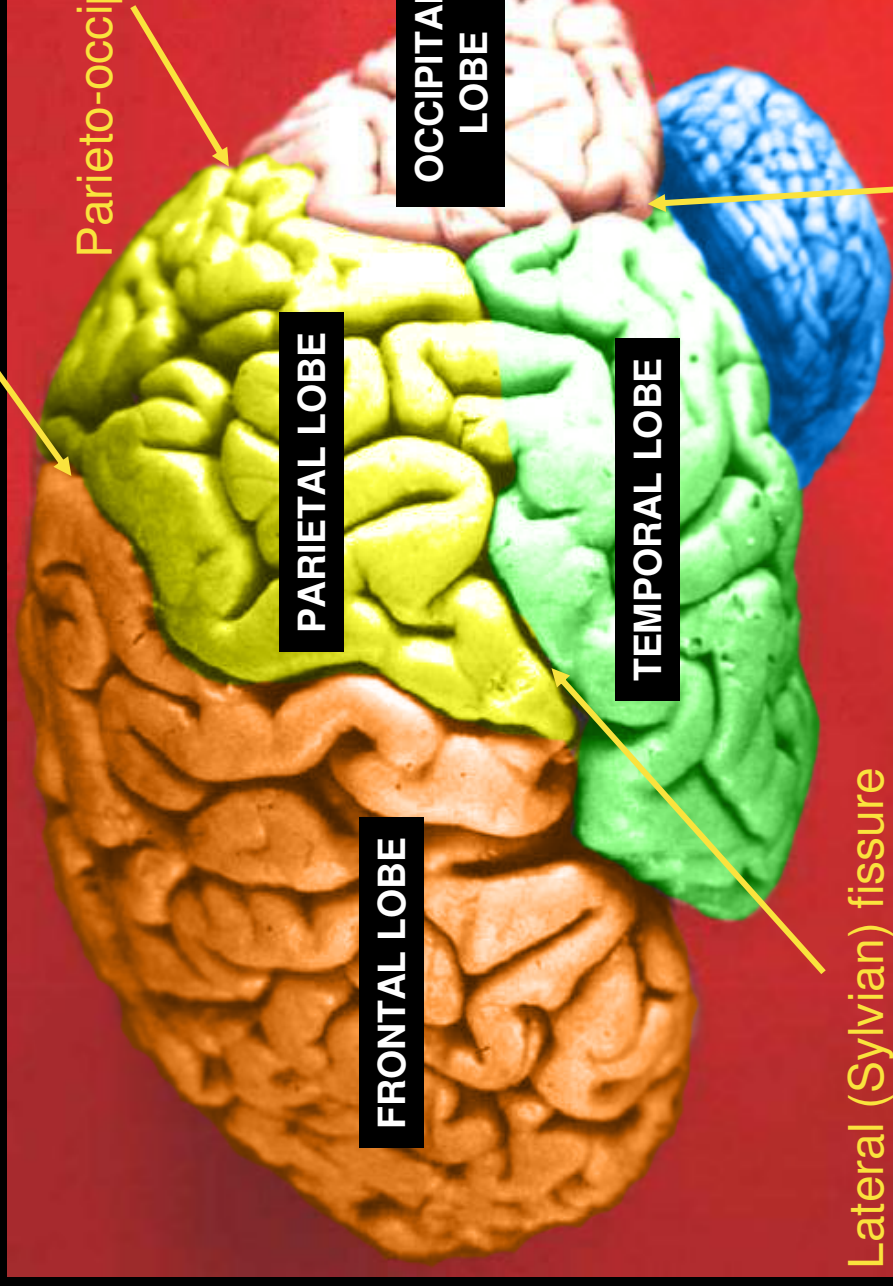
Cortex



- Composed of GYRI (the 'HILLS') and SULCI (the 'VALLEYS')
- If a sulcus is very deep → FISSURE (E.g. Lateral fissure)
- Some sulci run LONGITUDINALLY, others in a MEDIAL-LATERAL direction
- 4 'undisputed' lobes (frontal, parietal, temporal and occipital) + insula (sometimes referred to as 'the fifth lobe').

Cortex

Central (Rolandic) fissure



Parieto-occipital fissure

PARIETAL LOBE

FRONTAL LOBE

OCCIPITAL LOBE

TEMPORAL LOBE

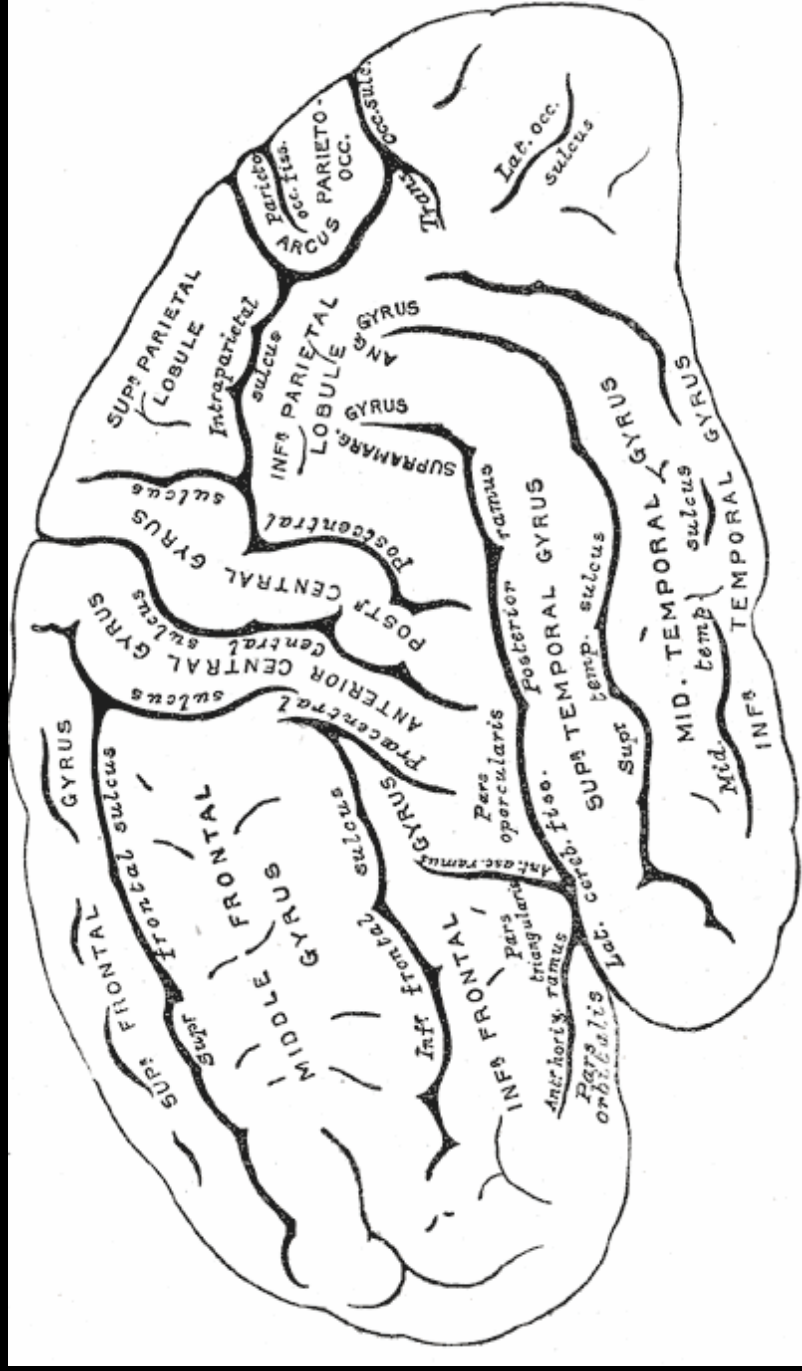
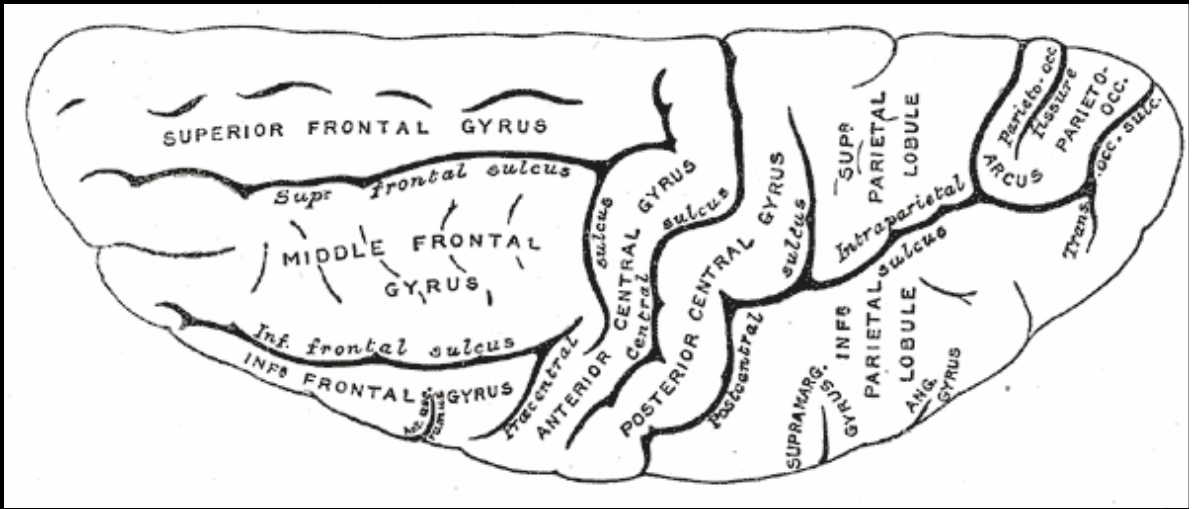
Lateral (Sylvian) fissure

Preoccipital notch

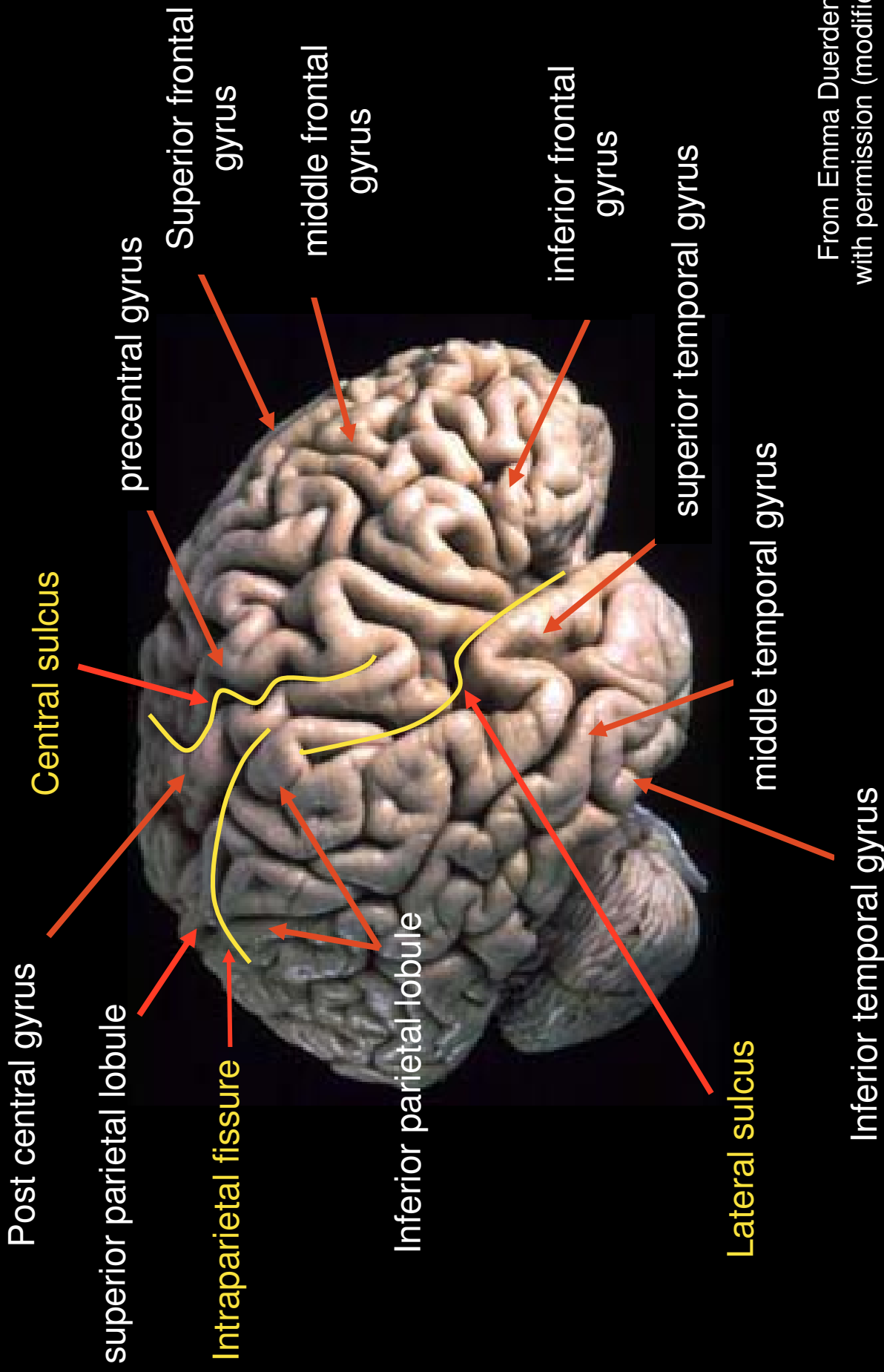
Cortex



GREY'S ANATOMY



Cortex

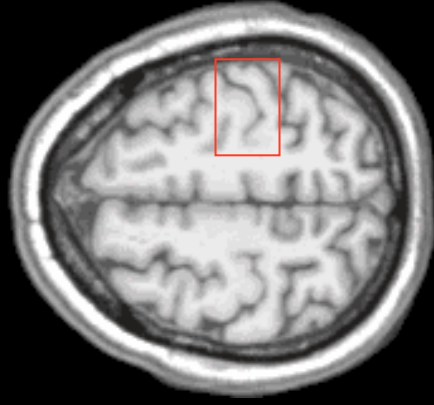
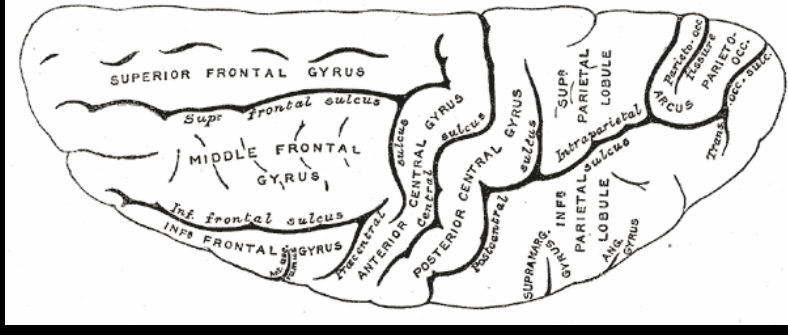
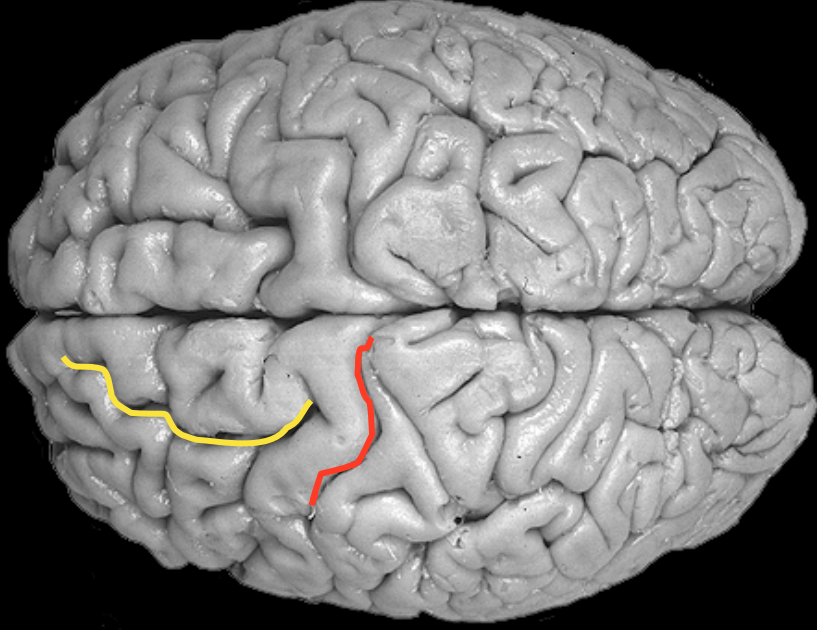


From Emma Duerden,
with permission (modified)

Cortex

Tips to find the **central sulcus**:

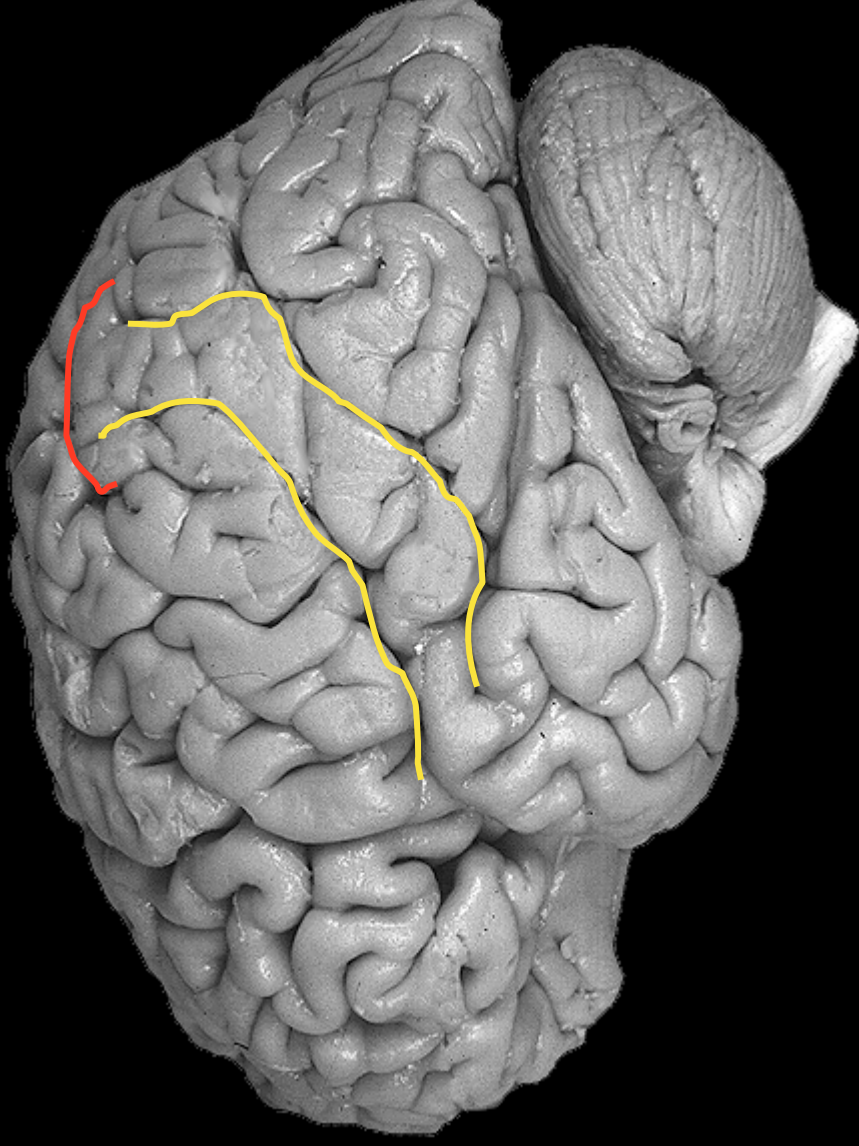
- 1) SFS stops at the precentral gyrus;
- 2) Look for the 'Omega shape' (motor hand area)



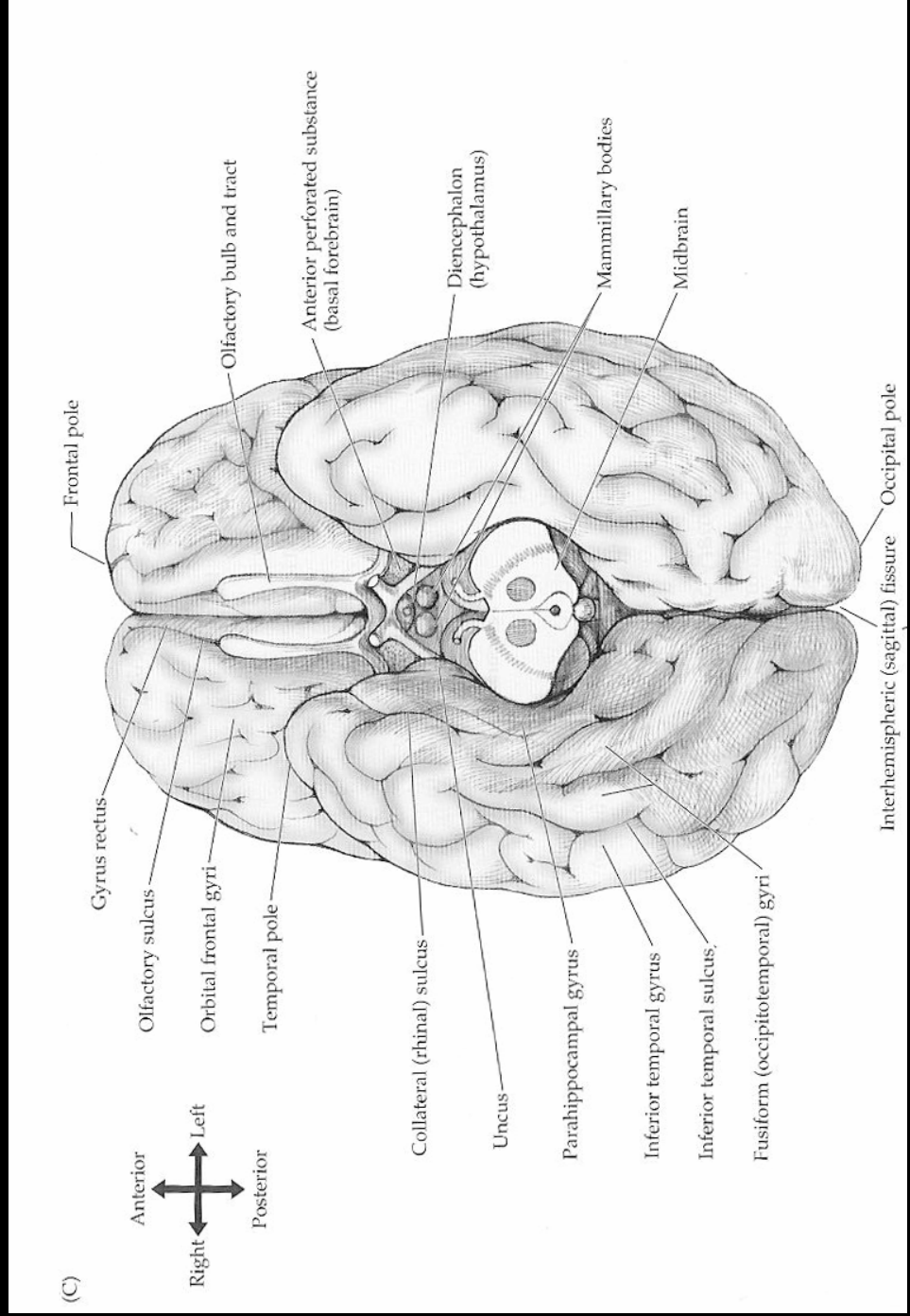
Cortex

Tip to find the **intraparietal sulcus**:

The lateral fissure and superior temporal sulcus stop at the Inf par lobule



Cortex



Cortex

Parieto-occipital
fissure

cuneus

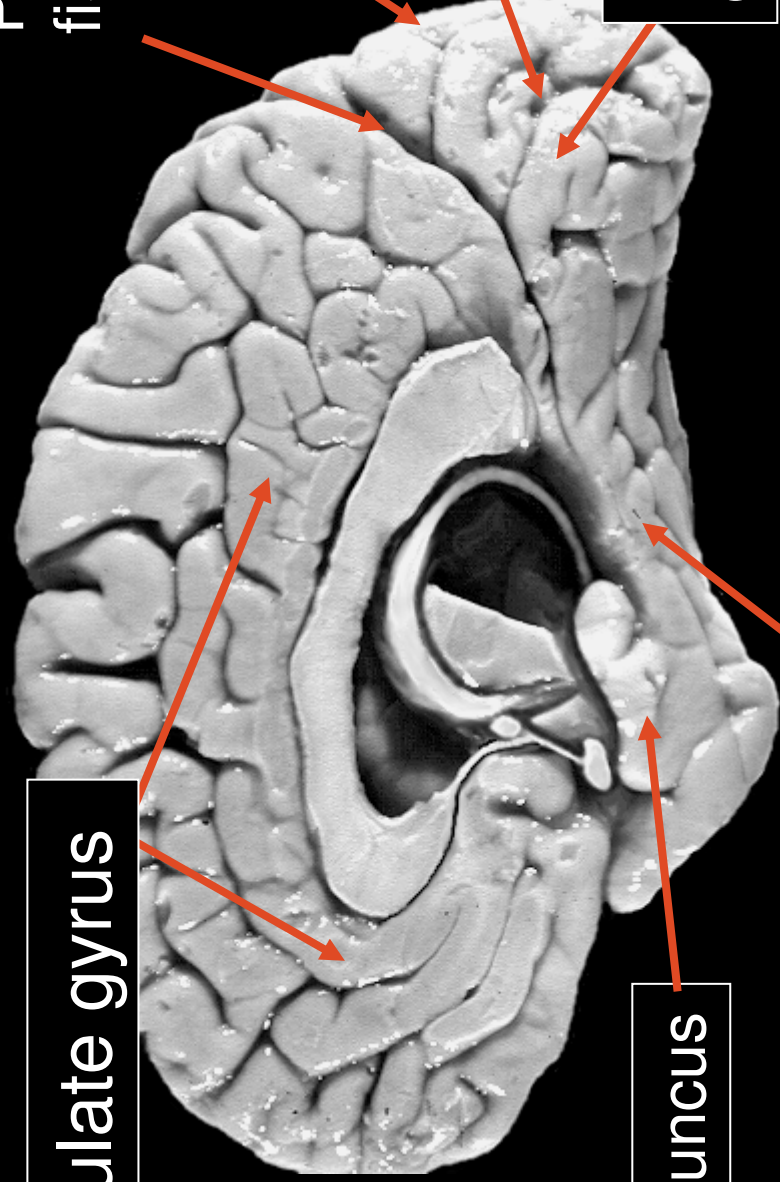
Calcarine
fissure

Lingual
gyrus

Cingulate gyrus

uncus

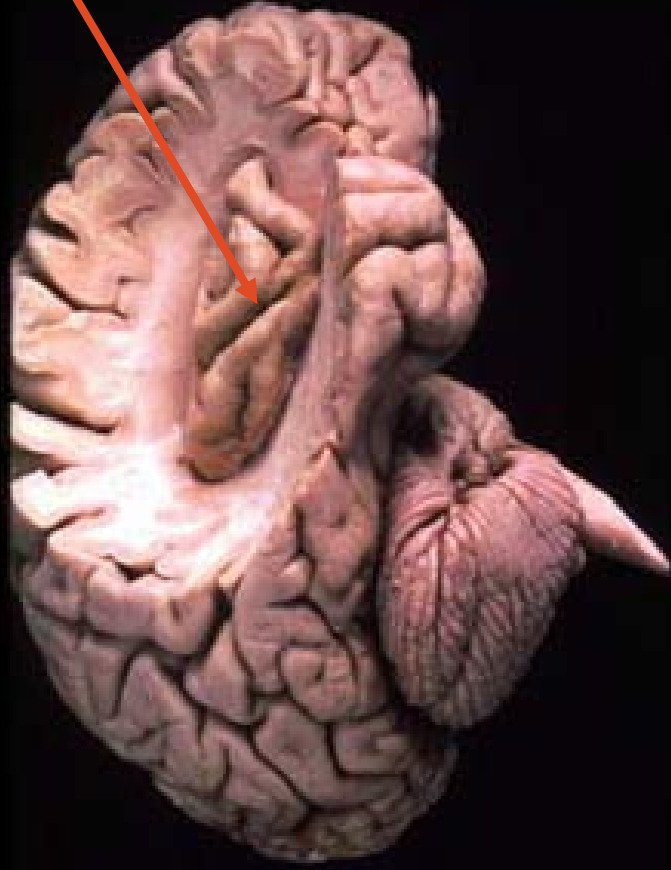
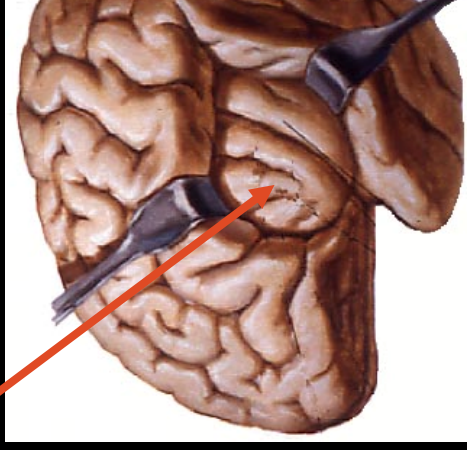
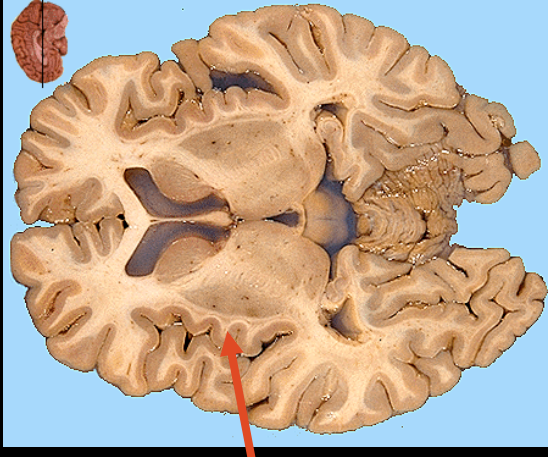
Parahippocampal
gyrus



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with permission

Cortex

Insula

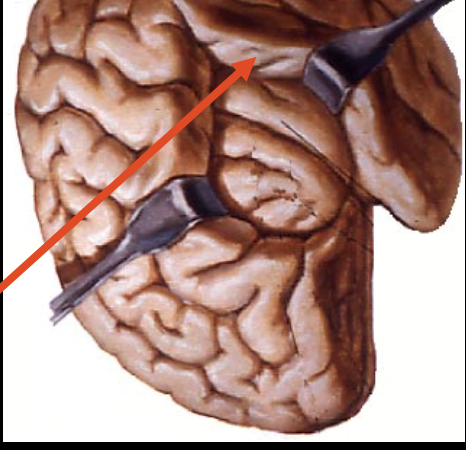


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Cortex



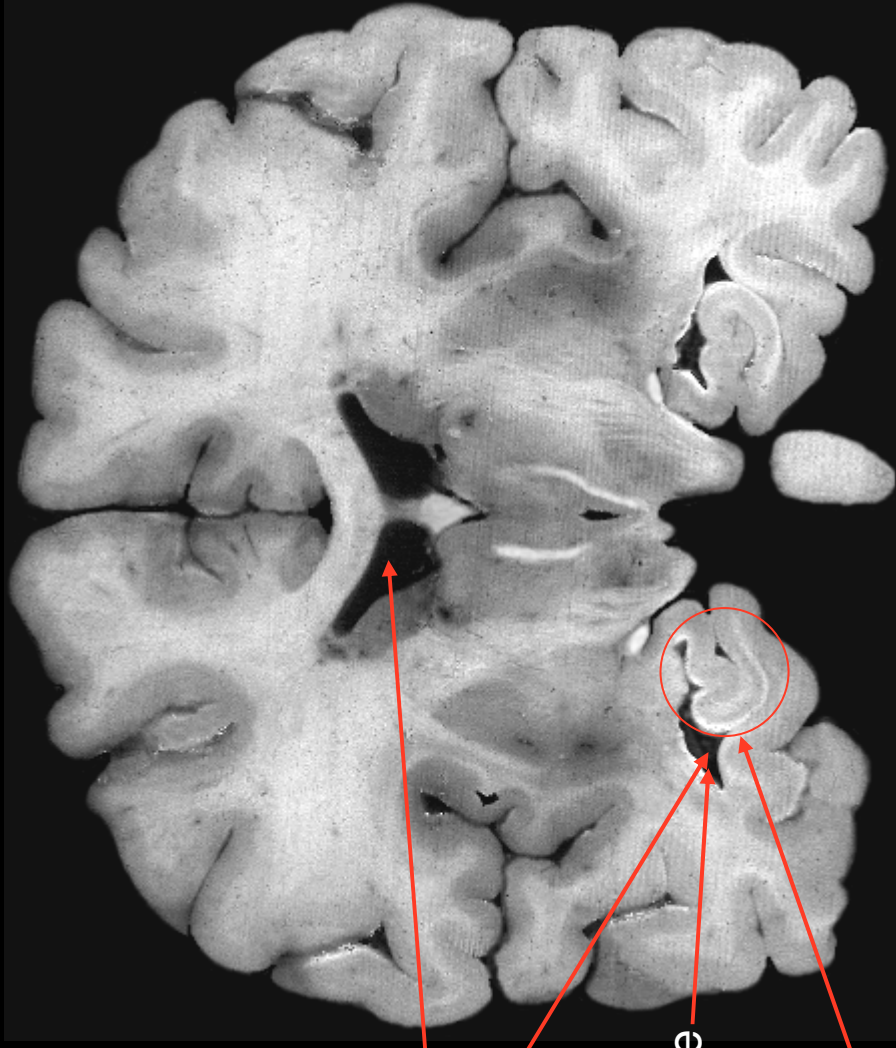
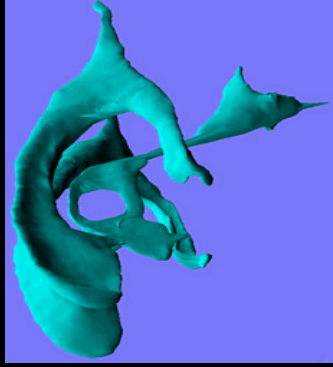
Heschl's
(transverse) gyri



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with permission (modified)

Hippocampus

Tip to find the **hippocampus**: Look below the inferior horn of the lateral ventricle!



Lateral ventricle

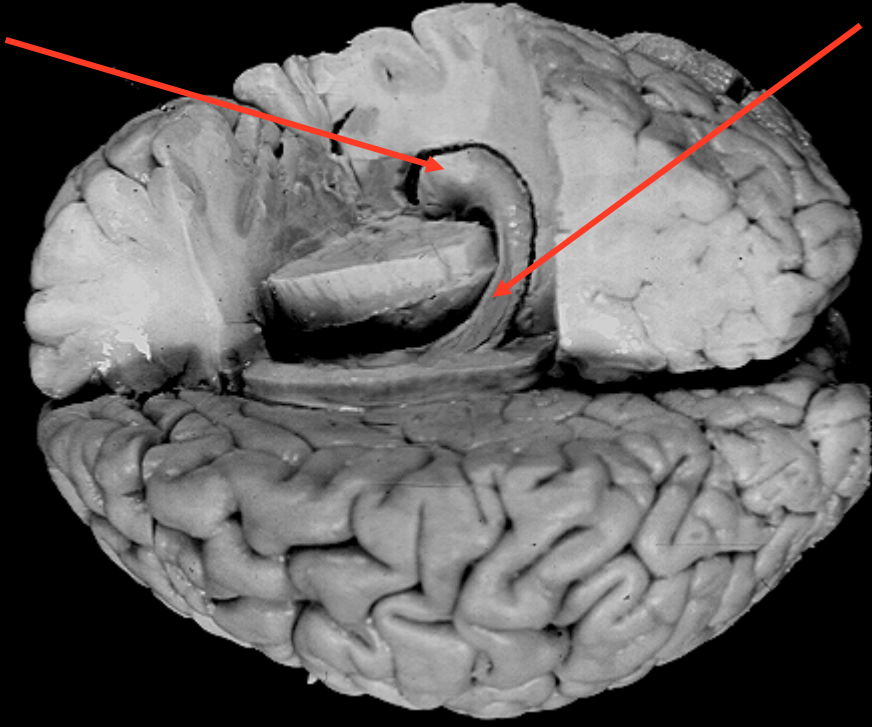
Inferior horn of the lateral ventricle

Hippocampus

Hippocampus

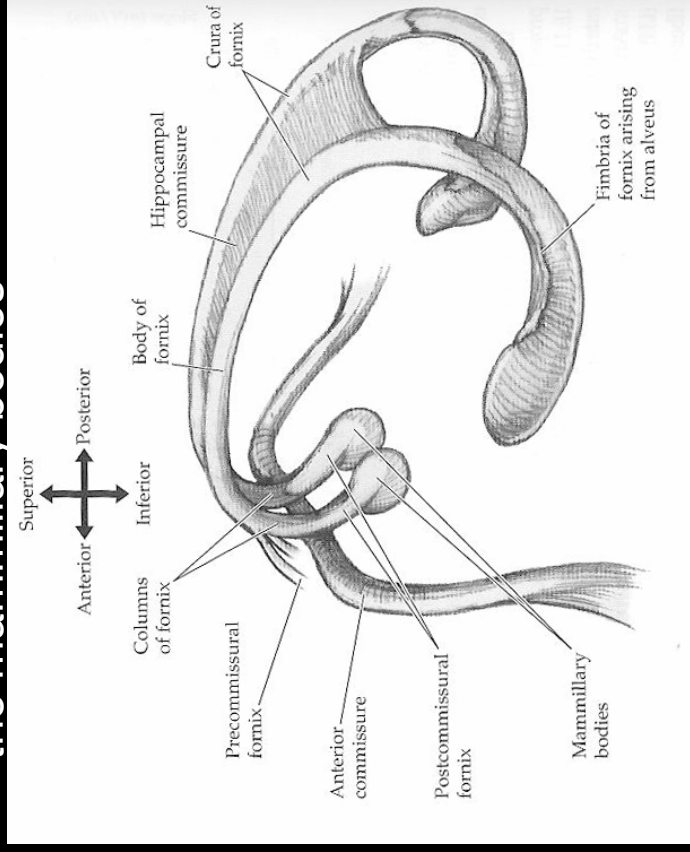


Hippocampus



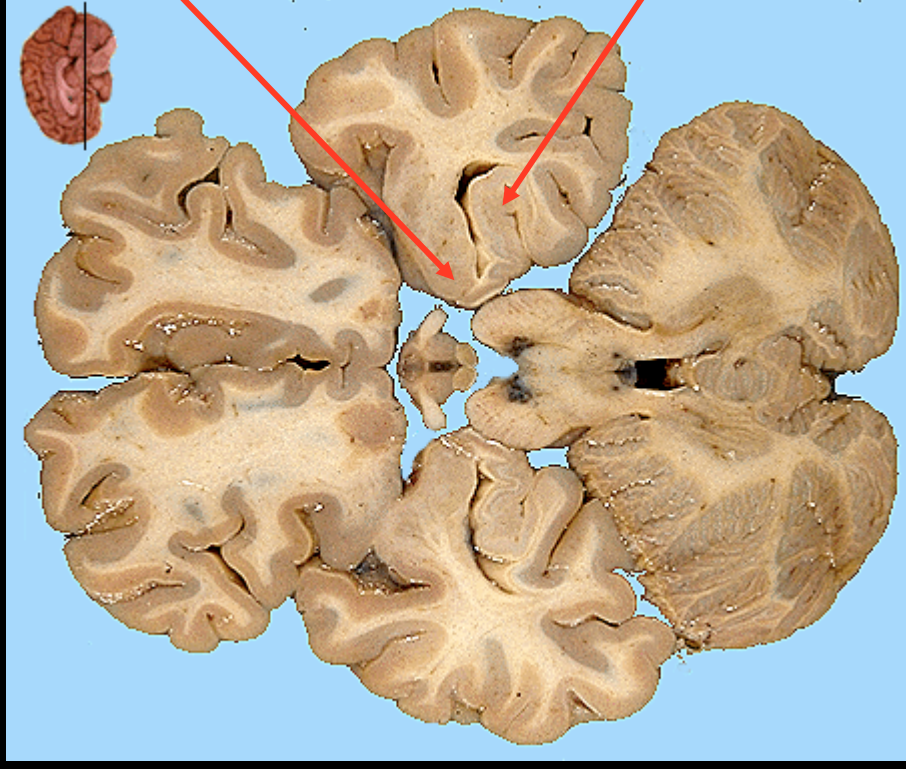
Fornix (the axons of the hippocampal neurons)

The fornix connects the hippocampus to the mammillary bodies



Hippocampus and Amygdala

Tip to find the **amygdala**: Look rostral to the hippocampus!

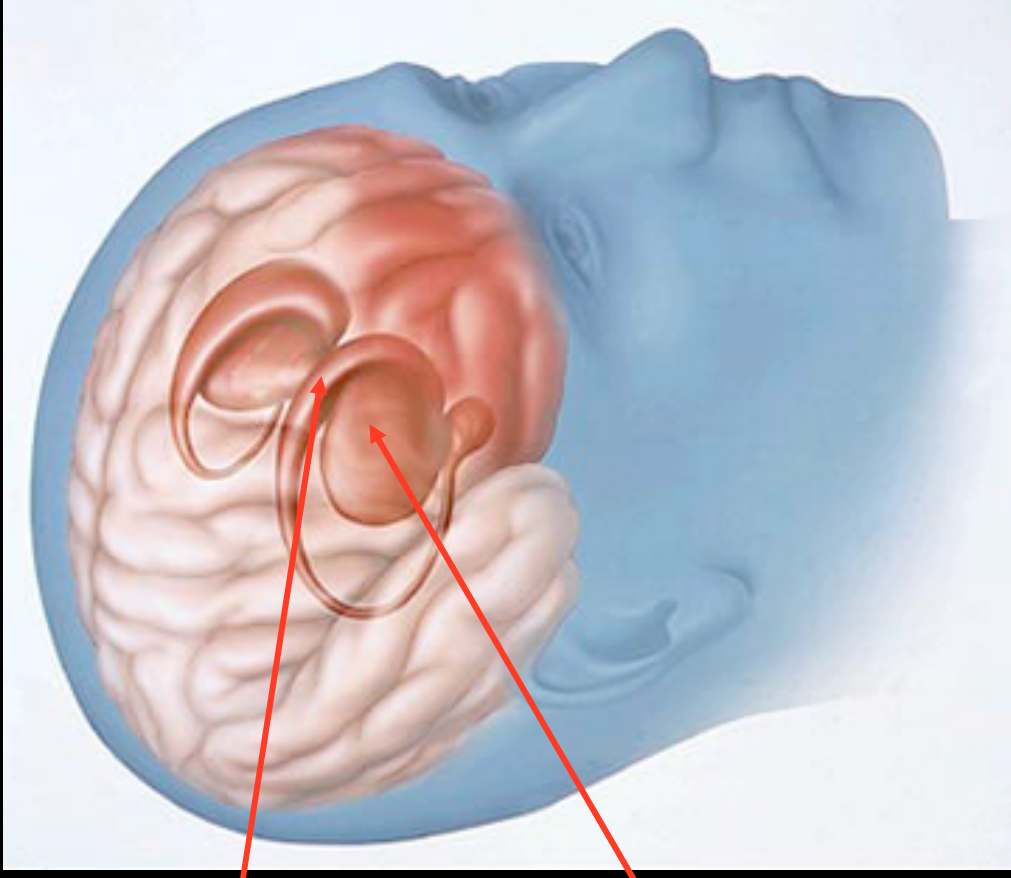


Amygdala

Hippocampus



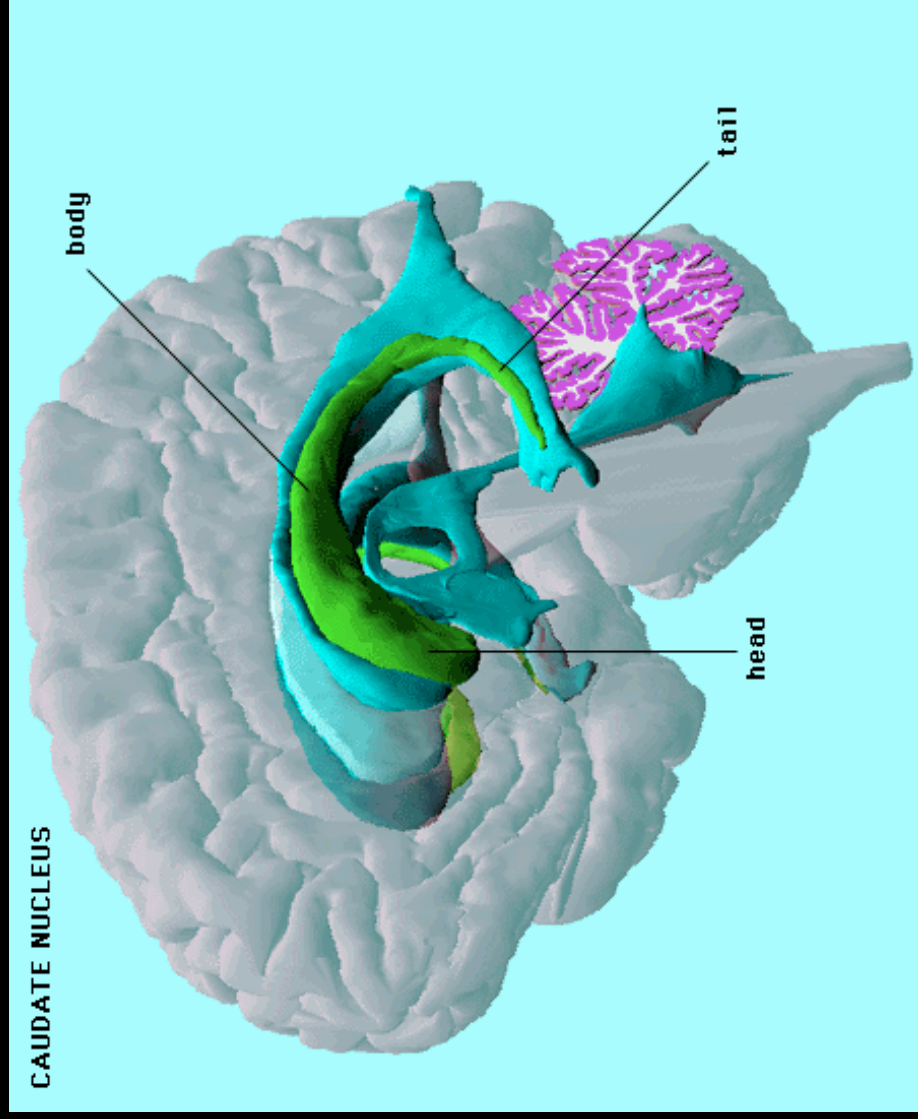
The basal ganglia



Caudate nucleus

Lentiform nucleus
(=putamen+
globus pallidus)

The basal ganglia



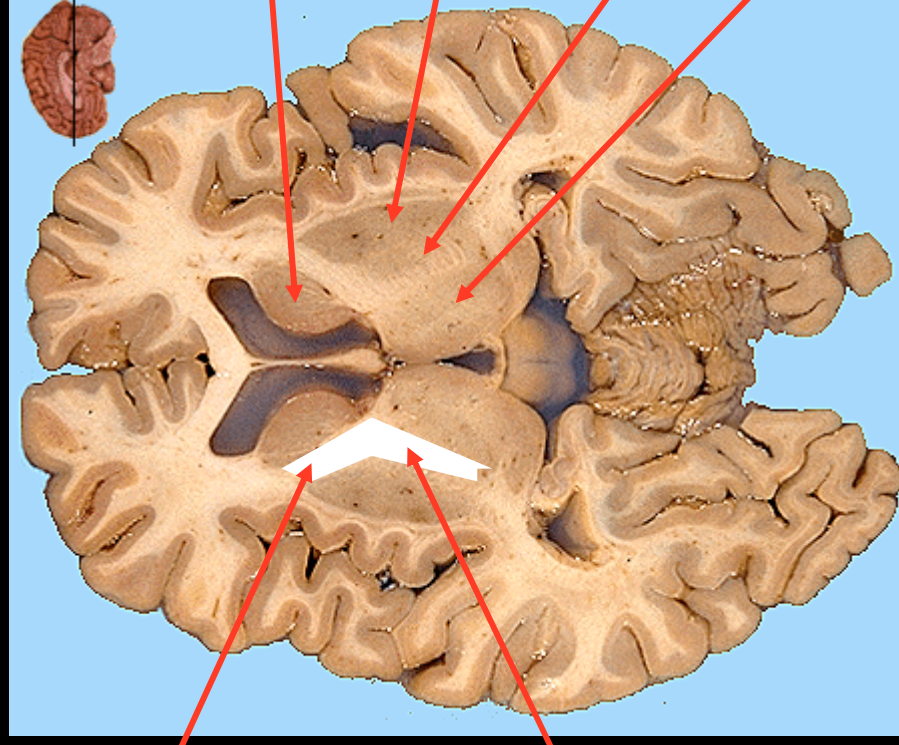
The basal ganglia

Tips to find the **basal ganglia**:

- 1) The nucleus bulging into the lateral ventricle is the head of the caudate
- 2) look for the L shaped white matter (internal capsule)!
- 3) 'Pallidus' means 'pale'....

Anterior limb of the Internal capsule: separates caudate from lentiform nucleus

Posterior limb of the Internal capsule: separates thalamus from lentiform nucleus



Caudate n. (head)

Lentiform nucleus
(putamen)

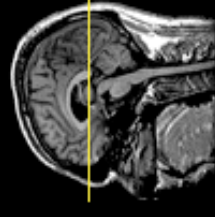
Lentiform nucleus
(globus pallidus)

Thalamus

The basal ganglia

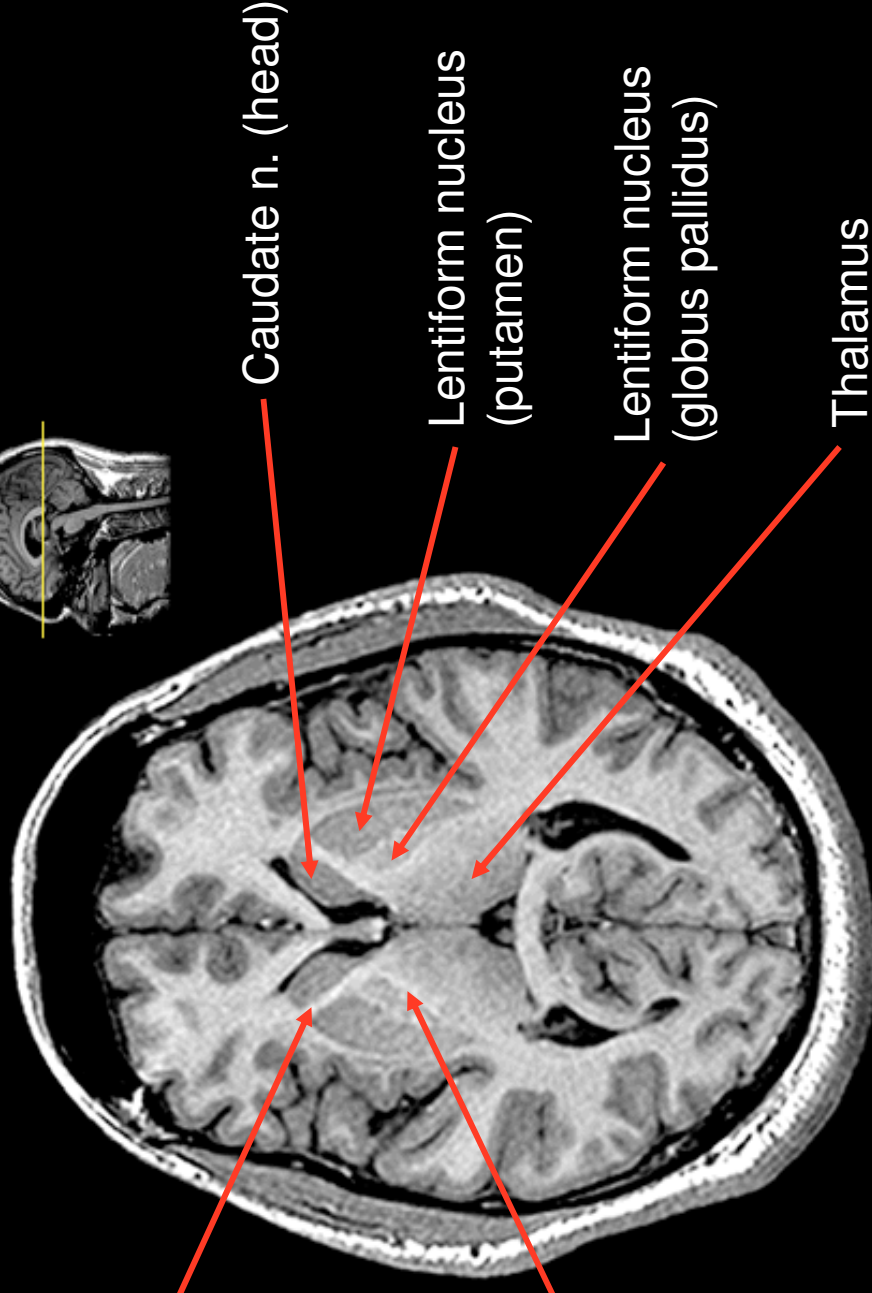
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Anterior limb of the Internal capsule: separates caudate from lentiform nucleus

Posterior limb of the Internal capsule: separates thalamus from lentiform nucleus



Caudate n. (head)

Lentiform nucleus (putamen)

Lentiform nucleus (globus pallidus)

Thalamus

Thanks!