

# Brain Cutting Manual

## Update 2021

Neuropathology Faculty involved in Brain cutting:

- Andrew Lieberman, MD, PhD (\*)      Chief of Neuropathology Division
- Sandra Camelo-Piragua, MD(#)      Neuropathology Fellowship, Program Director
- Sriram Venketi, MD, PhD (#)
- Sean Ferris, MD, PhD (\*)
- Kyle Conway, MD (!)

(\*) ADRC only

(#) Adult and pediatric Medical autopsies and Medico-Legal consultations

(!) Estimated to join the team May 2022



## NP Faculty (Brain cutting)



**Sandra I. Camelo-Piragua, MD**

Associate Professor  
Neuropathology

Neuropathology Fellowship  
Program Director



**Sriram Venneti, MD, PhD**

Associate Professor  
*AI and Robert Glick Family  
Research*  
Professor of Pediatrics  
Experimental Pathology



**Andrew P. Lieberman, MD, PhD**

Gerald D. Abrams Collegiate Professor  
Neurodegenerative Disease  
Director of Neuropathology

**ADRC**



**Sean Ferris, MD, PhD**

Assistant Professor  
Neuropathology

## NP Fellows

2021-2023



**Emile Pinarbasi, MD, PhD**

## NP Admin



**Gran, Gerson**

Administrative Assistant Intermediate H

734-936-1889

**E-Mail:** [ggran@med.umich.edu](mailto:ggran@med.umich.edu)

# Neuropathology Resources

<https://www.pathology.med.umich.edu/internal/tools-training>

**DEPARTMENT OF PATHOLOGY** **LABORATORIES** **COVID19 RESOURCES** **INSIDE PATHOLOGY**

Anatomic Clinical Education Experimental Informatics Molecular

Calendars  
Pathology Directory  
UM Directory  
Employee Recognition  
Forms  
HO Internal Page  
MSTAR  
PathCMS Admin  
Policies & Procedures  
Tools & Training

**Anatomic Pathology**  
Autopsy & Forensic Case Reports  
Cutting Manual  
Cutting Manual (Neuropathology Brain)  
Cytopath Telepathology  
ImmunoQuery Training Video  
Kellogg Specimen Tracking Tool  
Molecular Testing, Block Requirements  
OR Specimen Tracker  
QA Meetings  
Reading Room Glance-Based Microscopy  
Sign-out Room Tools  
SoftPathDx Training Information  
Sterile Lung Biopsies with a partner  
Sterile Lung Biopsies no partner

Cardiovascular

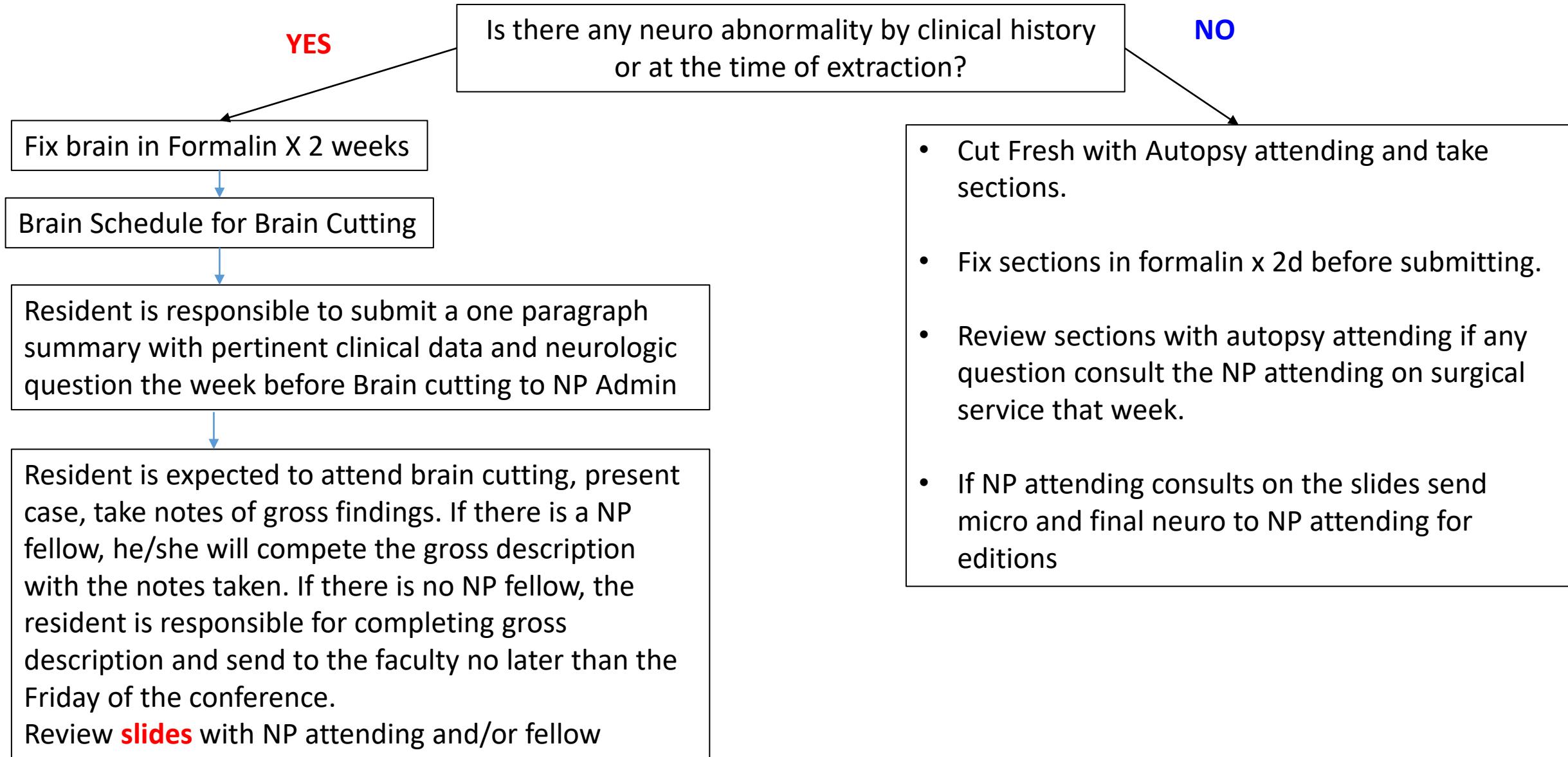
Central Nervous System (Neuropathology, Nerve and Muscle)

- CJD Biopsy Procedure
- Grossing of Nerve Biopsy
- MiOncoSeq Brain Tumor Protocol
- Muscle Freezing and Grossing Procedure
- Muscle Preparation for the House Clinicians
- Nerve Preparation for in house clinicians
- Temporal Lobectomy for Epilepsy

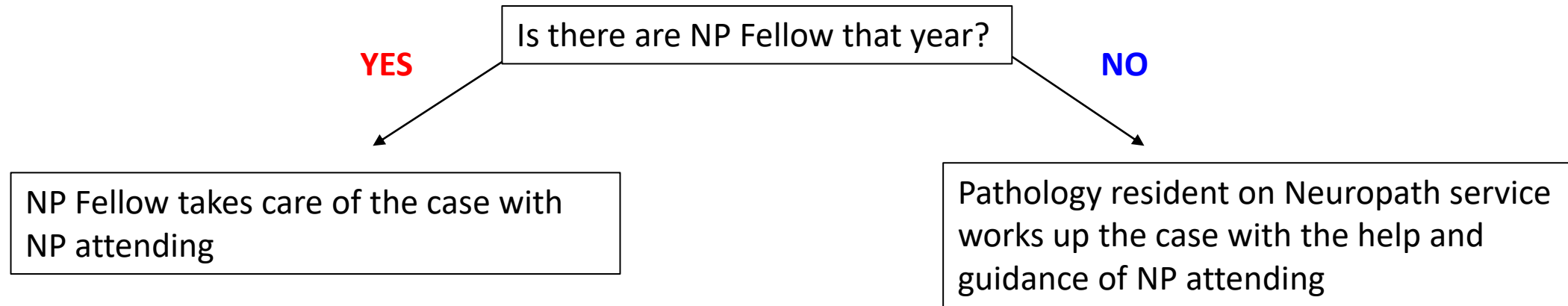
Decalcification

# Brain Cutting Workflow

# Full Adult Medical Autopsy



# Neurodegenerative Cases (ADRC) or Brain only autopsies



# Medico-Legal Autopsy



```
graph TD; A[Medico-Legal Autopsy] --> B[Forensic Pathologist may decide there is Neuro question to be addressed. Fix brain in Formalin X 2 weeks and schedule for Brain cutting contacting the UMHS morgue coordinator who will put the case in Queue to be cut at conference.]; A --> C[• Cut Fresh with Forensic Pathology attending and take sections.]; A --> D[• Fix sections in formalin]; A --> E[• Review sections with Forensic Pathology attending. if any question consult the NP attending on surgical service that week.]; A --> F[• For Forensic cases NP attending guides and helps Forensic Pathology team but NP attending name DOES NOT go in the report]; B --> G[Forensic trainee or attending is responsible to submit a one paragraph summary with pertinent clinical data and neurologic question the week before Brain cutting to NP Admin]; G --> H[• For Forensic cases NP attending guides and helps Forensic Pathology team but NP attending name DOES NOT go in the report.]; G --> I[• Forensic Pathology team writes and edits the report]; H --> J[Alternatively, cases will go to Forensic Pathologist with Neuropathology expertise]; I --> J;
```

Forensic Pathologist may decide there is Neuro question to be addressed. Fix brain in Formalin X 2 weeks and schedule for Brain cutting contacting the UMHS morgue coordinator who will put the case in Queue to be cut at conference.

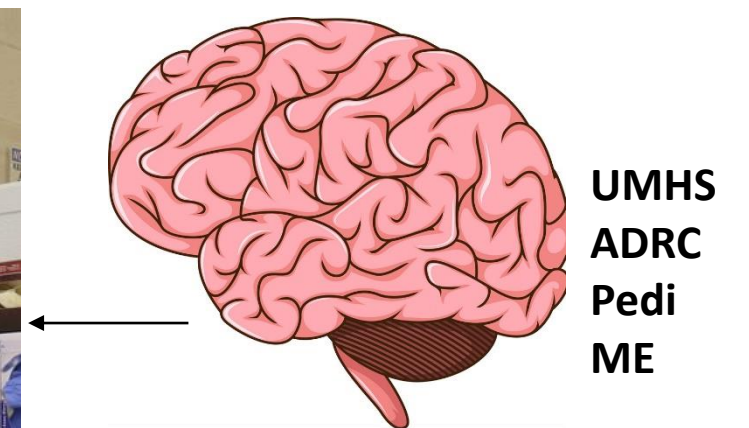
Forensic trainee or attending is responsible to submit a one paragraph summary with pertinent clinical data and neurologic question the week before Brain cutting to NP Admin

- For Forensic cases NP attending guides and helps Forensic Pathology team but **NP attending name DOES NOT go in the report.**
- Forensic Pathology team writes and edits the report

- Cut Fresh with Forensic Pathology attending and take sections.
- Fix sections in formalin
- Review sections with Forensic Pathology attending. if any question consult the NP attending on surgical service that week.
- For Forensic cases NP attending guides and helps Forensic Pathology team but **NP attending name DOES NOT go in the report**

Alternatively, cases will go to Forensic Pathologist with Neuropathology expertise









## Neuropathology: Specimens from autopsy Brain Conference

Conference Date:

AU/ME#:

Name:

Fresh specimen weight:

Postmortem interval:

Clinical History:

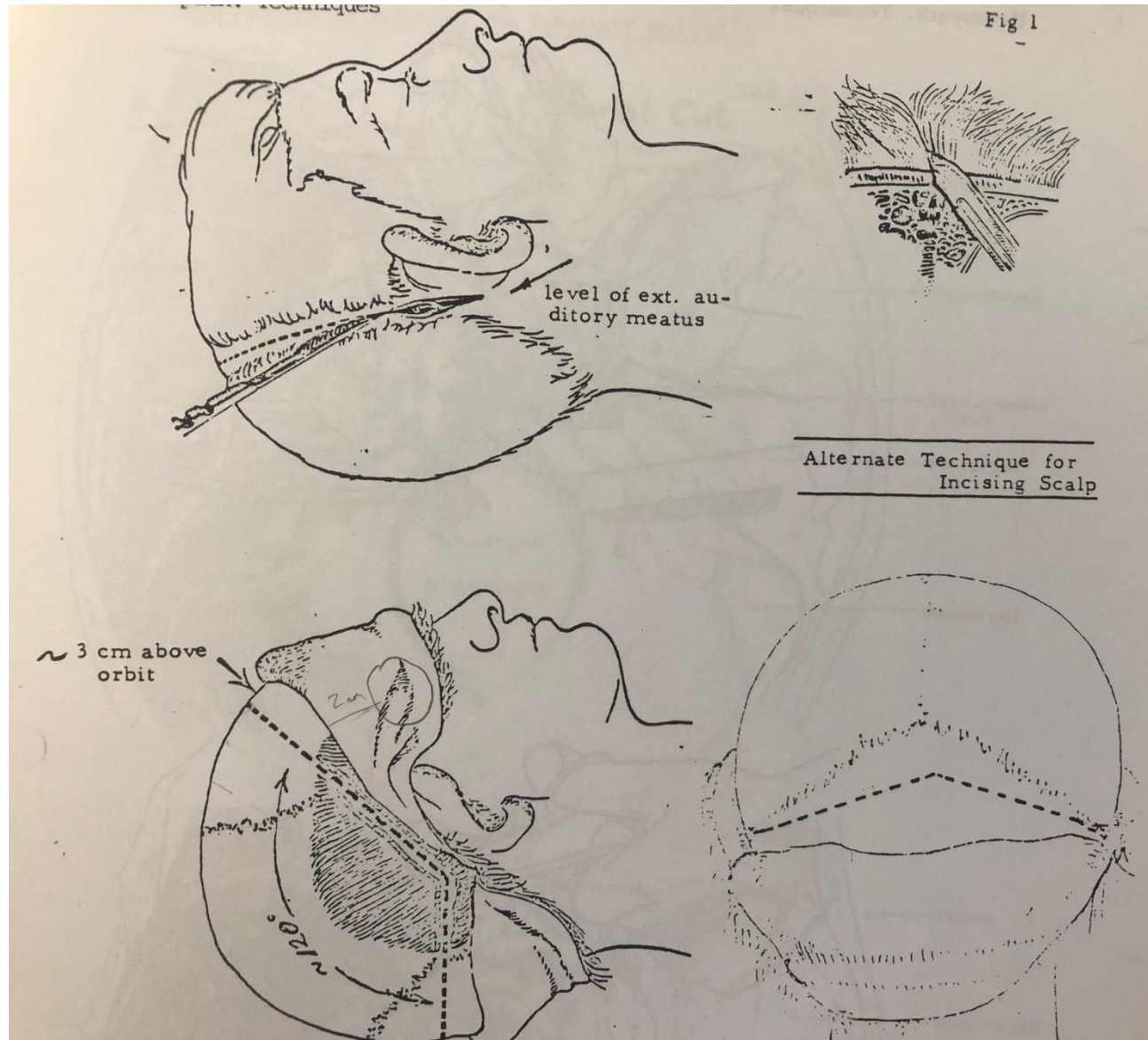
Indications:

Specific questions for neuropathology:

## Brain cutting: Tuesday 1pm NCRC

- Fill out the NP Brain Conference form as soon as you are done with your autopsy
- Check your email to review when your case is scheduled for conference (usually 2 weeks later)
- Attend Brain cutting conference. Come prepared with clinical history and any pertinent general autopsy findings
- If no NP fellow, the resident is expected to complete Gross Neuropathologic Examination and send NP faculty no later than Friday
- NP fellow receives slides and review with resident
- NP faculty reviews case gives feedback

# Brain Removal Adults



# Normal Adult Brain Weight 1,200-1,400 g





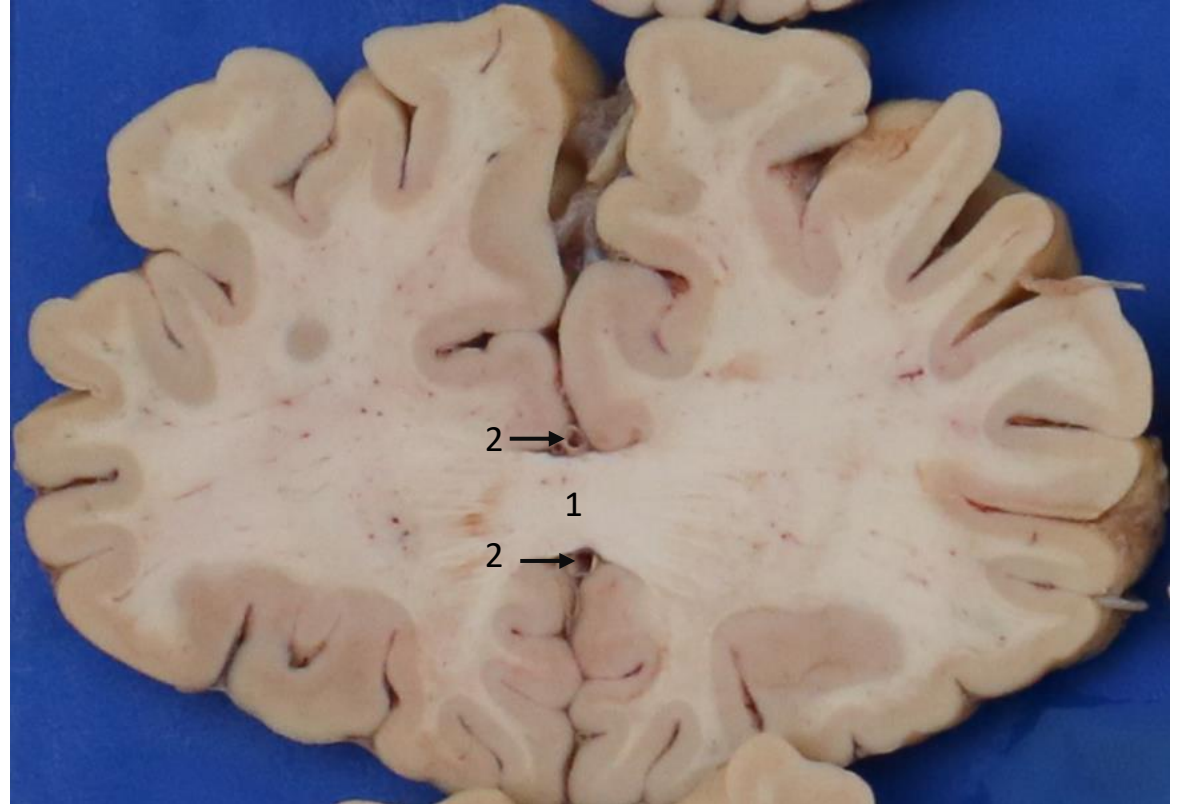


# Brain Landmarks

1. At the anterior tip of the temporal lobes



Frontal lobes

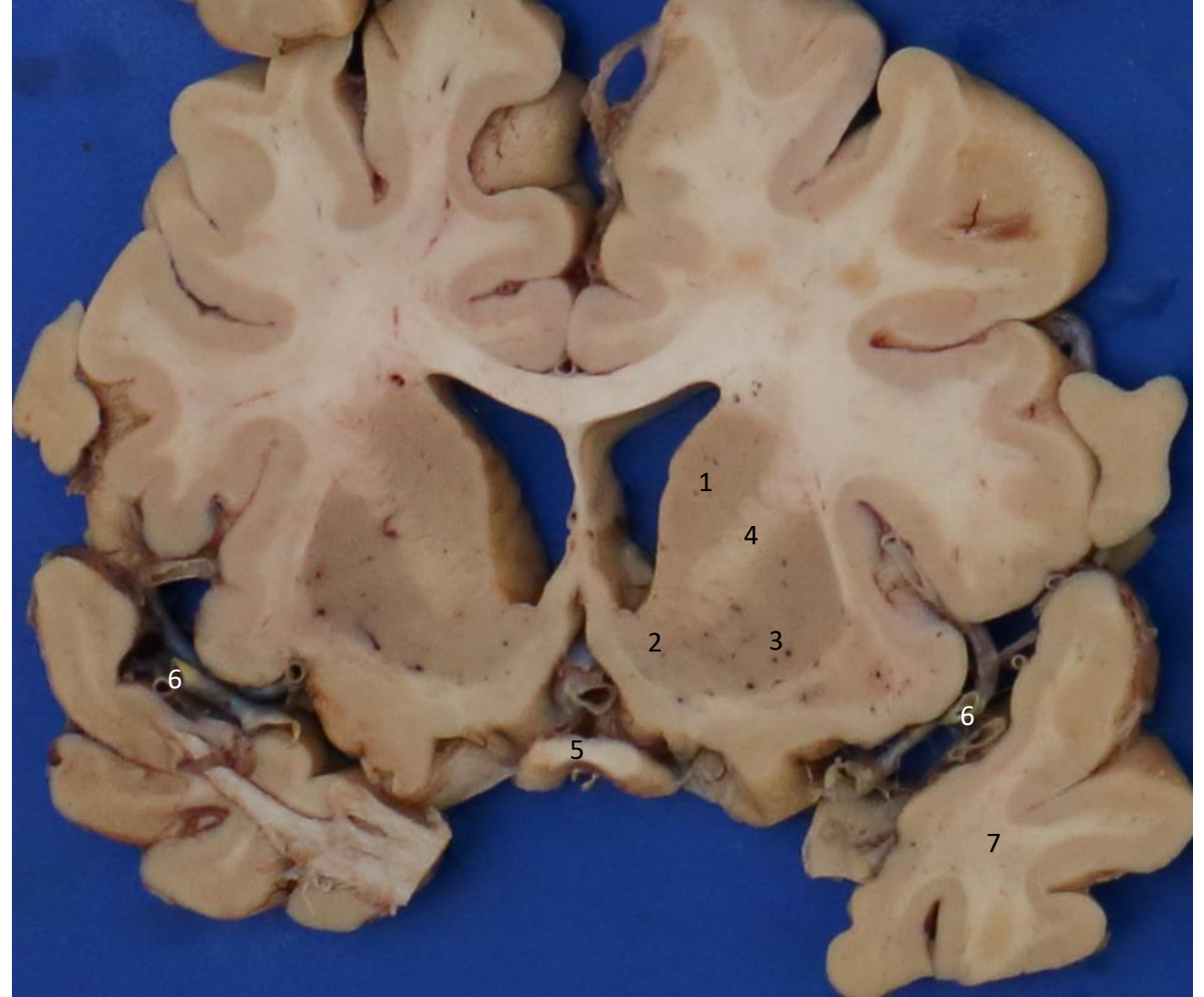
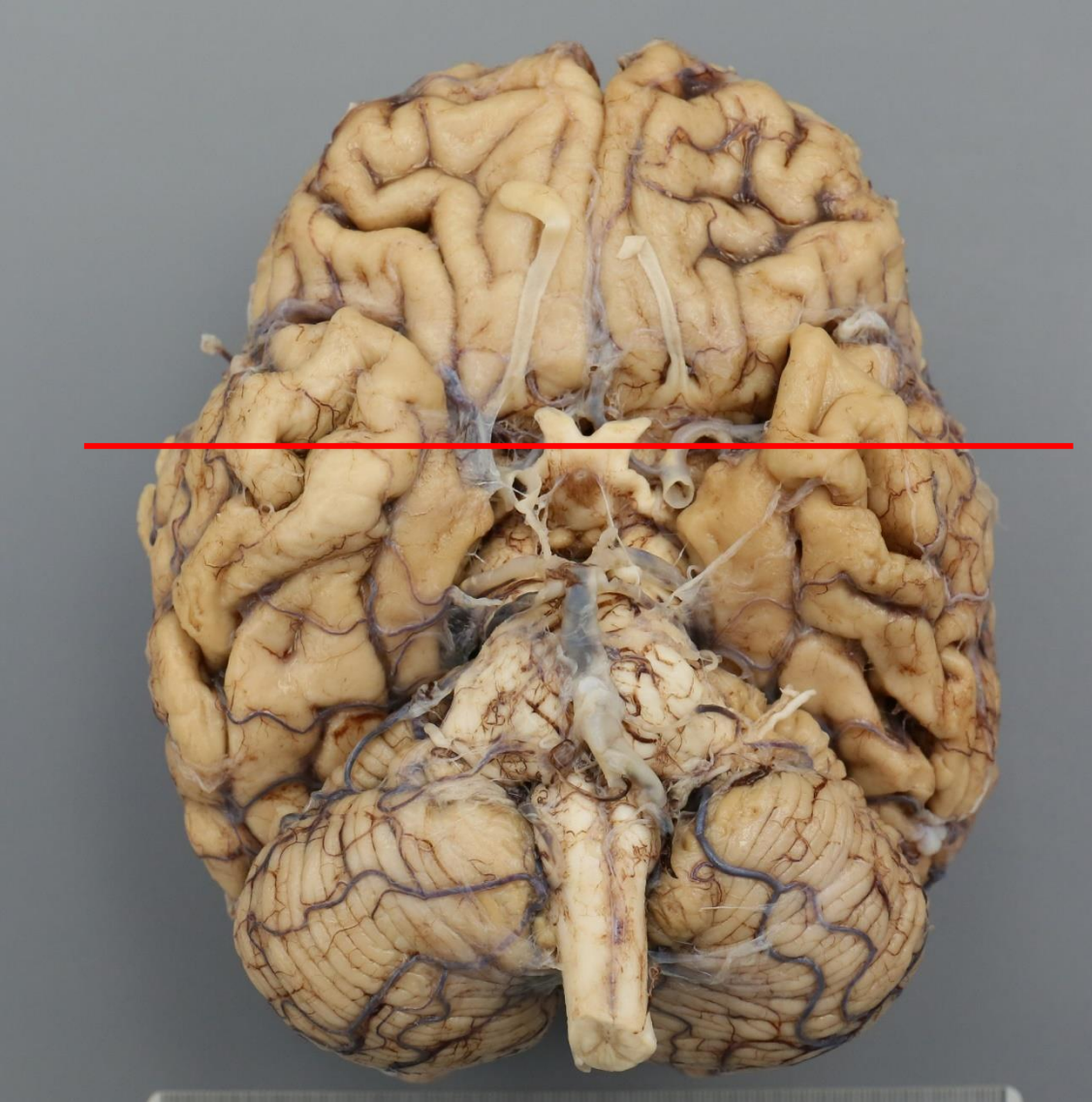


1. Genu of Corpus callosum
2. ACA



# Brain Landmarks

## 2. At the Chiasm

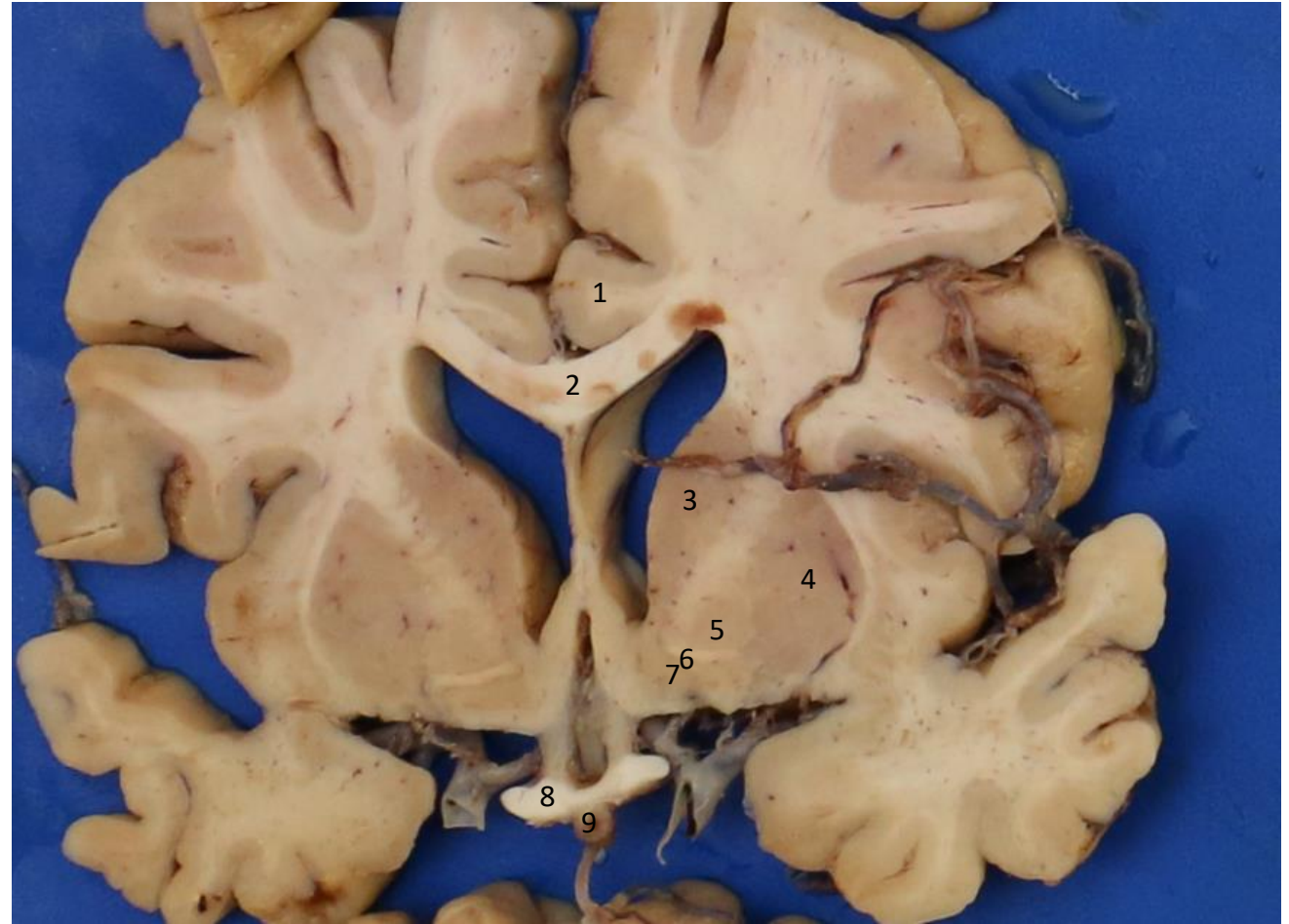
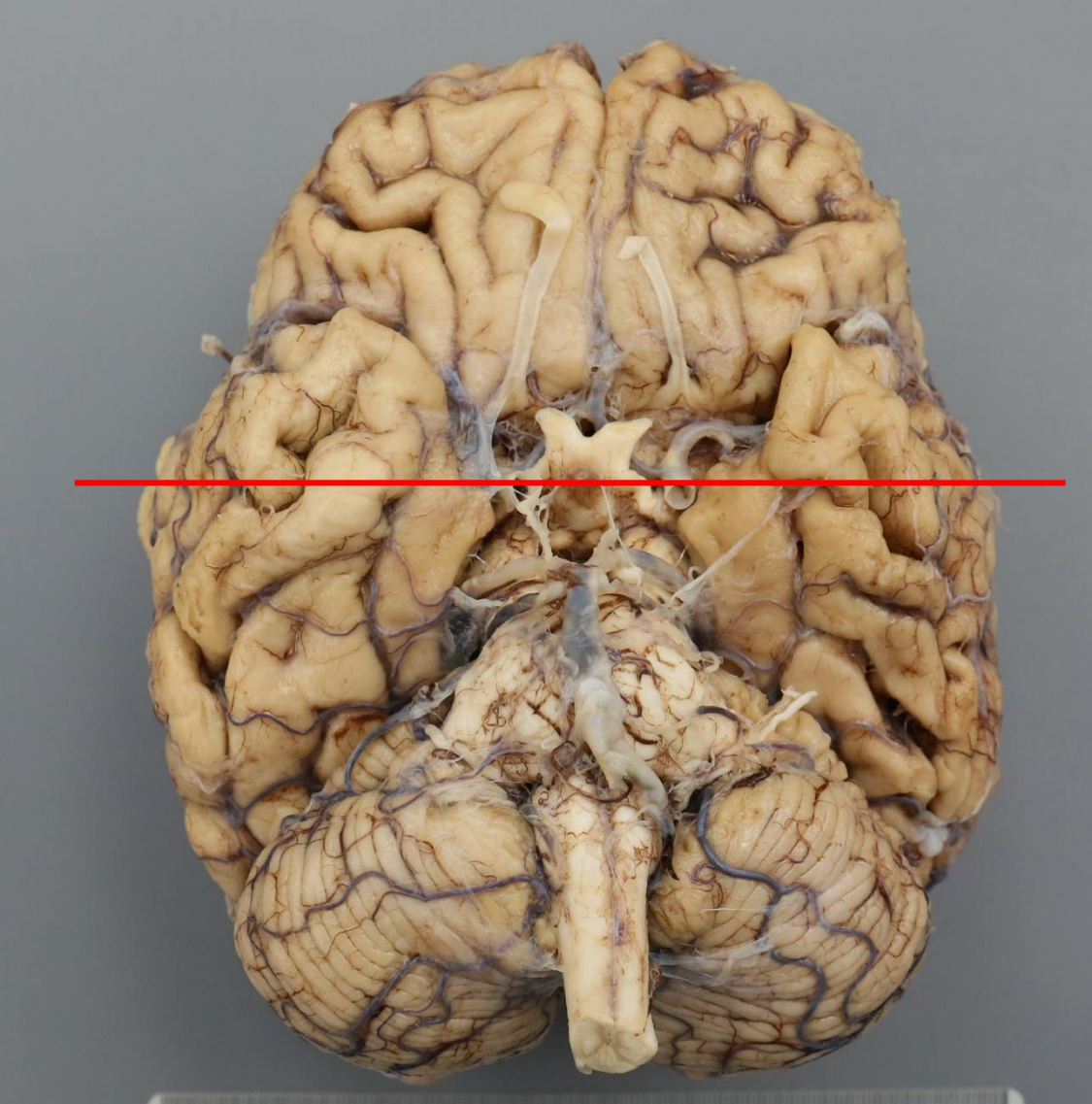


- |              |                     |                  |
|--------------|---------------------|------------------|
| 1. Caudate   | 4. Internal capsule | 7. Temporal Lobe |
| 2. Accumbens | 5. Chiasm           |                  |
| 3. Putamen   | 6. MCA              |                  |



# Brain Landmarks

## 3. At the pituitary stalk



- |                    |                        |
|--------------------|------------------------|
| 1. Cingulate       | 5. Globus pallidus     |
| 2. Corpus callosum | 6. Anterior Commissure |
| 3. Caudate         | 7. Nucleus Basalis     |
| 4. Putamen         | 8. Optic Tract         |
|                    | 9. Pituitary stalk     |



# Brain Landmarks

## 4. At the mammillary bodies

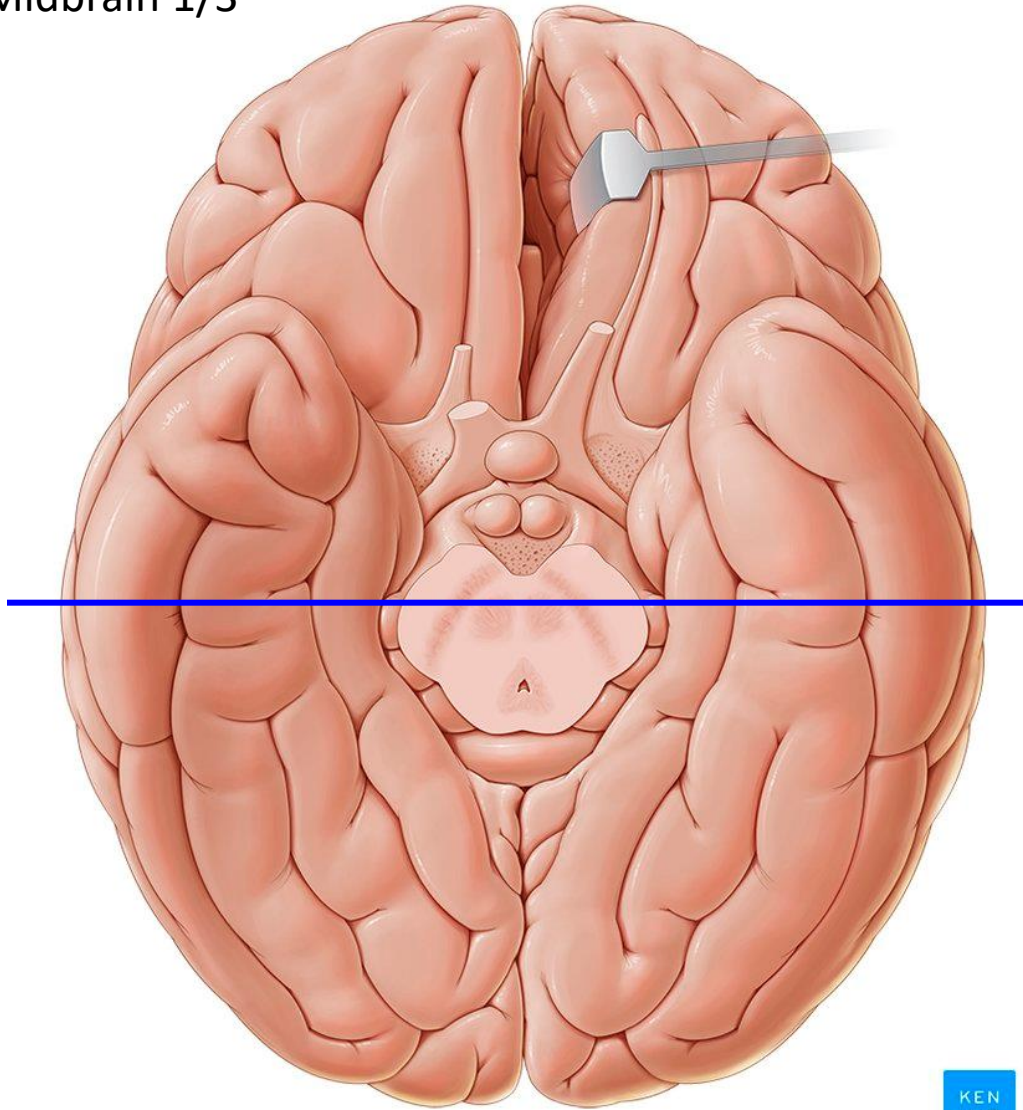


- |                      |                         |
|----------------------|-------------------------|
| 1. Caudate           | 5. Putamen              |
| 2. Thalamus          | 6. Insular cortex       |
| 3. Mammillary bodies | 7. Amygdala             |
| 4. 3rd Ventricle     | 8. Anterior hippocampus |

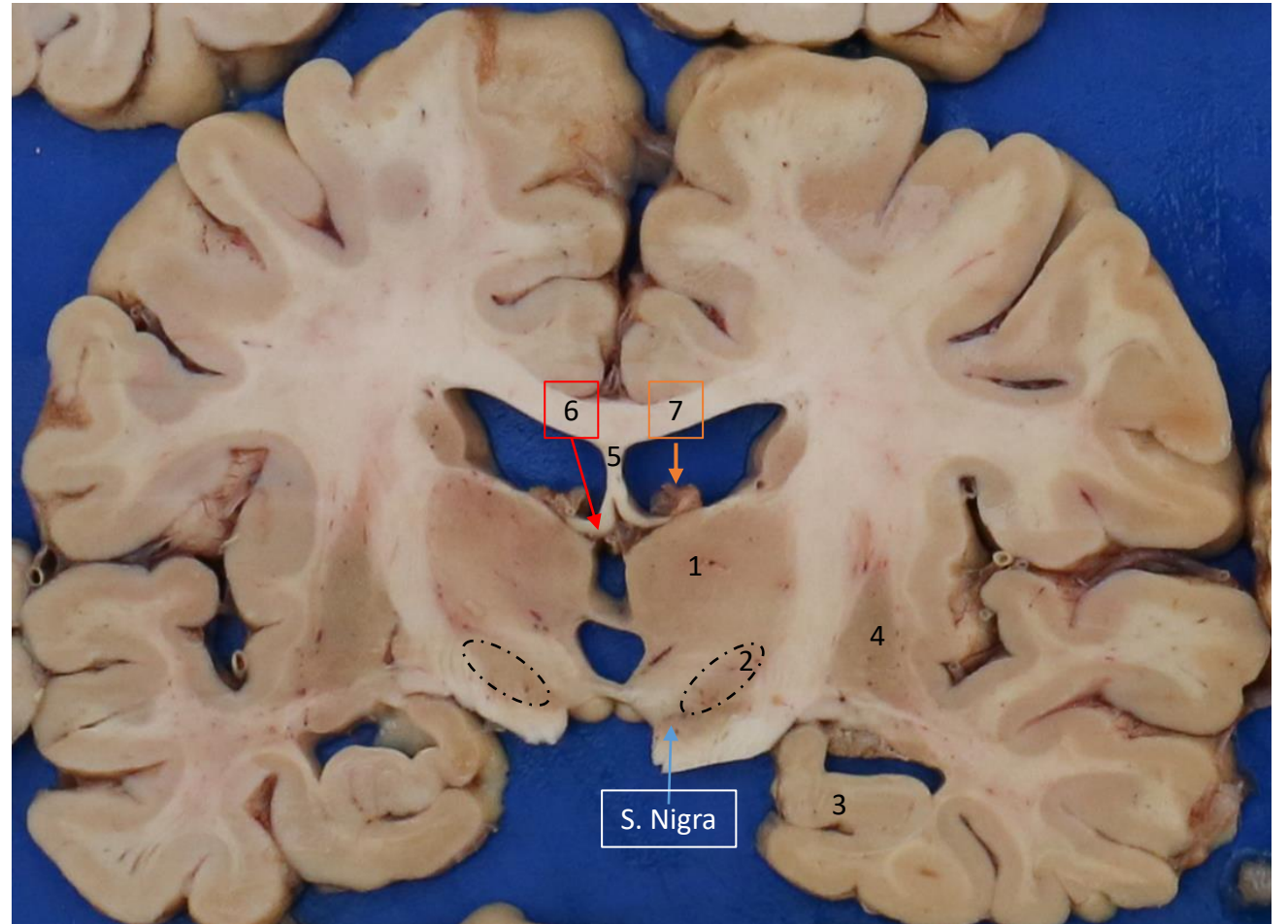


# Brain Landmarks

## 5. Midbrain 1/3



© www.kenhub.com



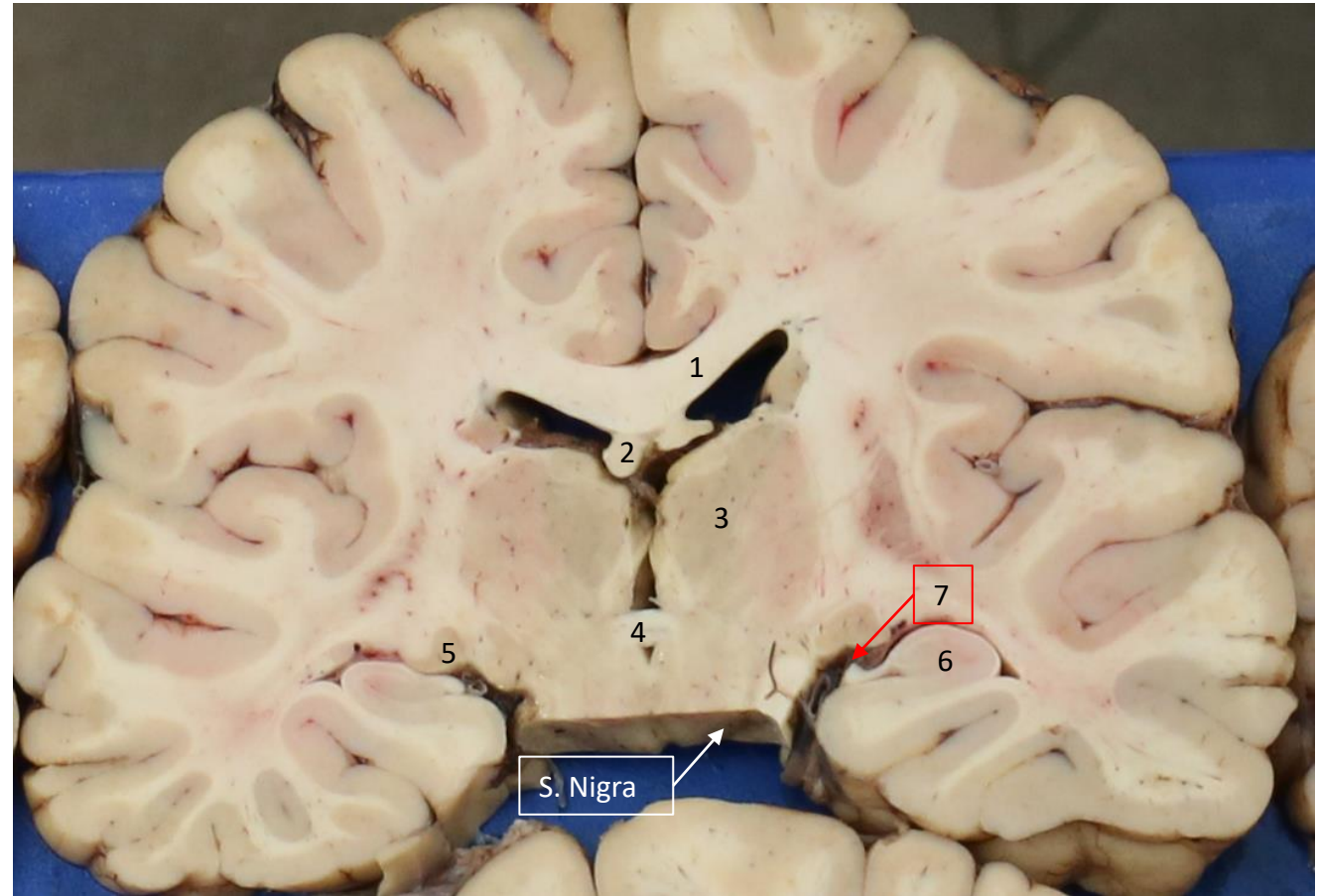
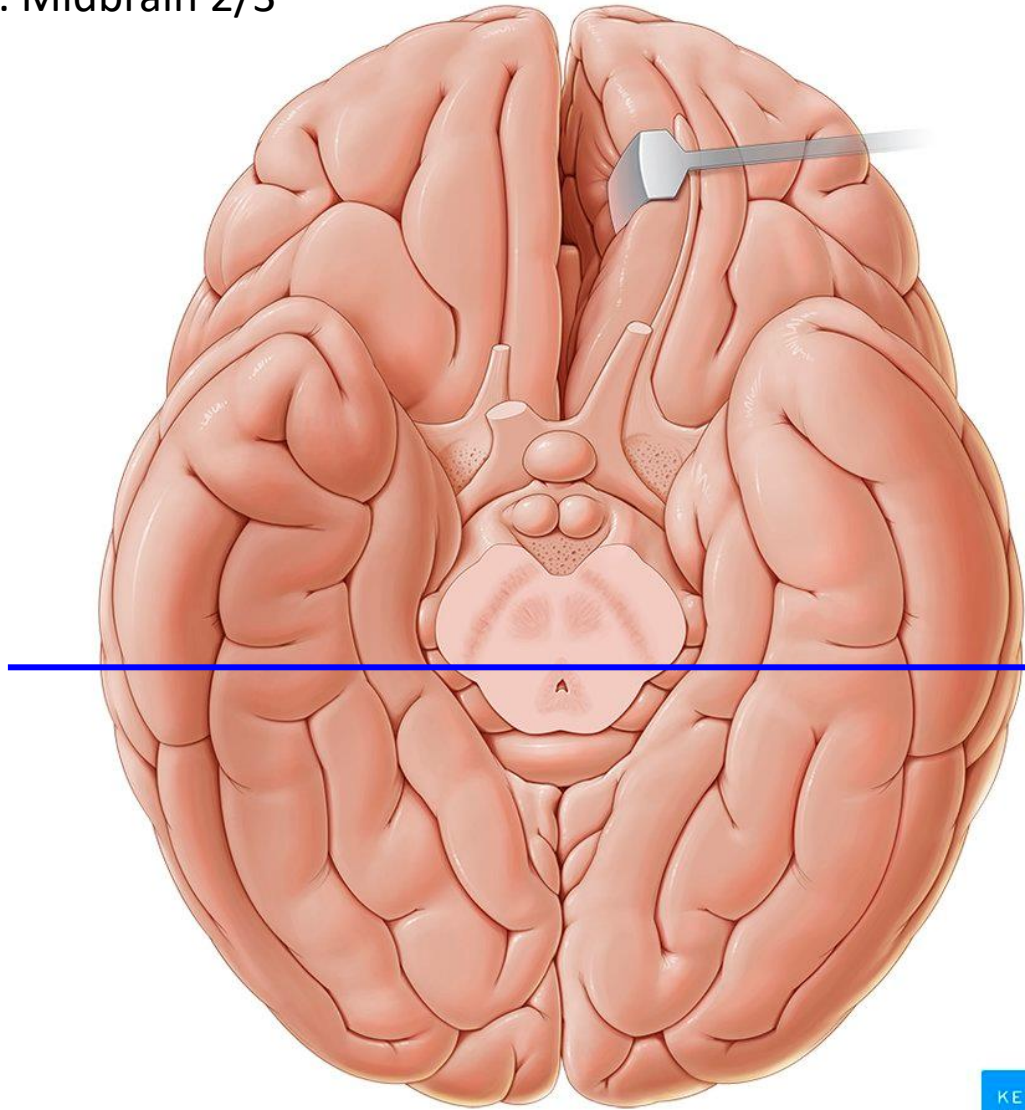
- 1. Thalamus
- 2. Subthalamic nucleus
- 3. Anterior hippocampus
- 4. Putamen

- 5. Septum pellucidum
- 6. Fornix
- 7. Choroid plexus



# Brain Landmarks

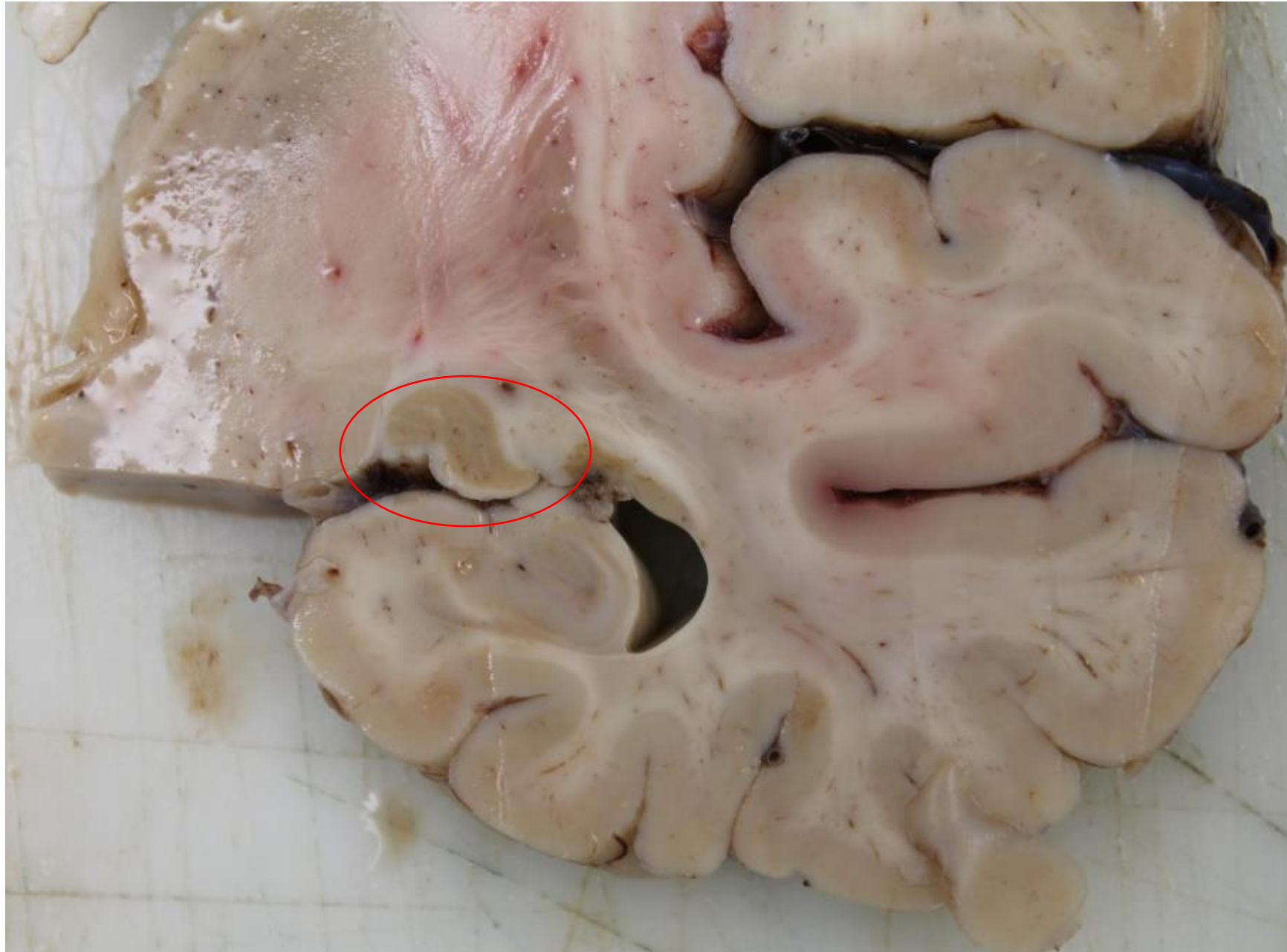
## 5. Midbrain 2/3



1. Corpus callosum
2. Fornix
3. Thalamus
4. Massa Intermedia

5. Lateral geniculate
6. Hippocampus
7. Fimbria



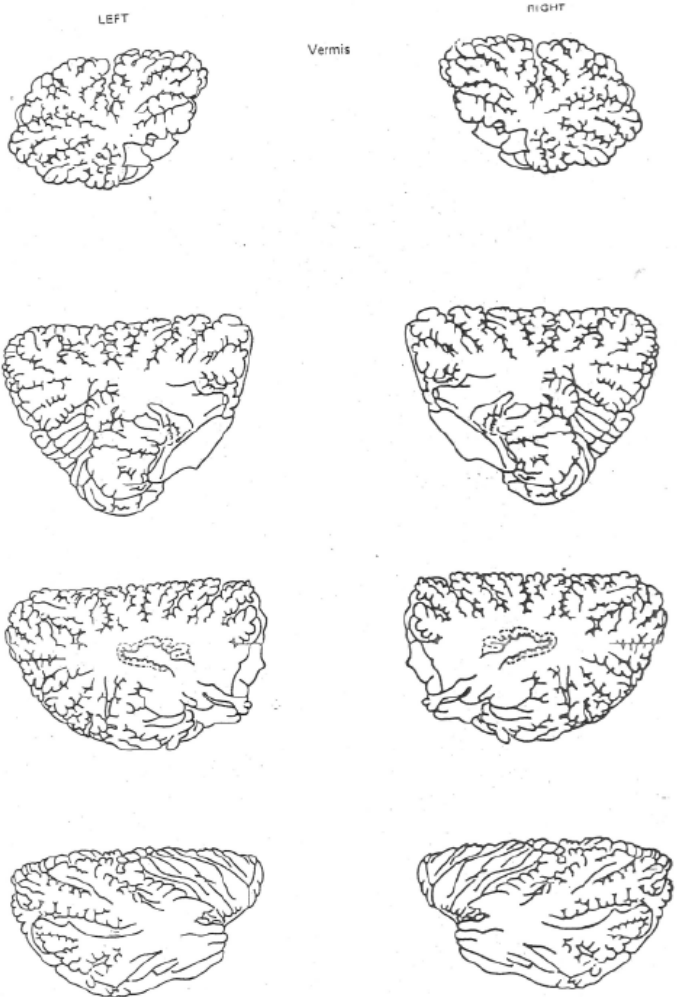
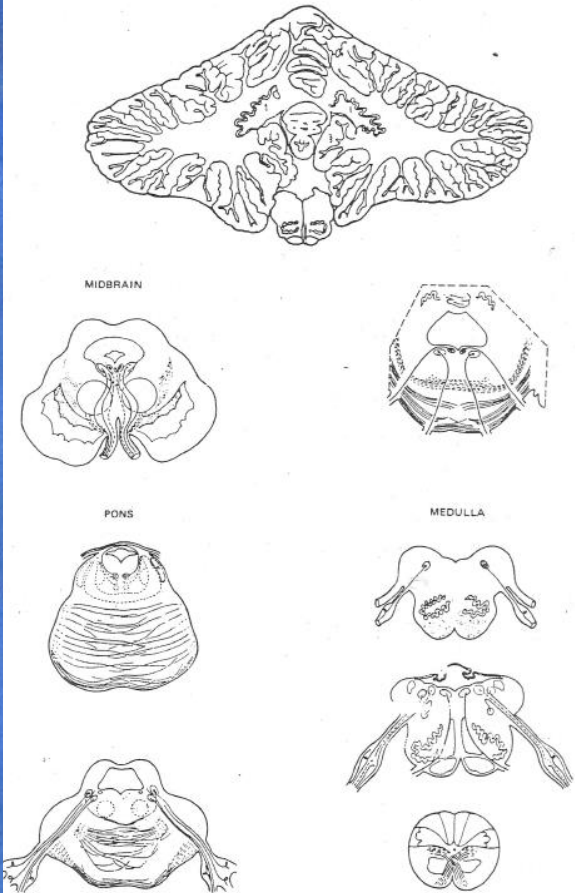
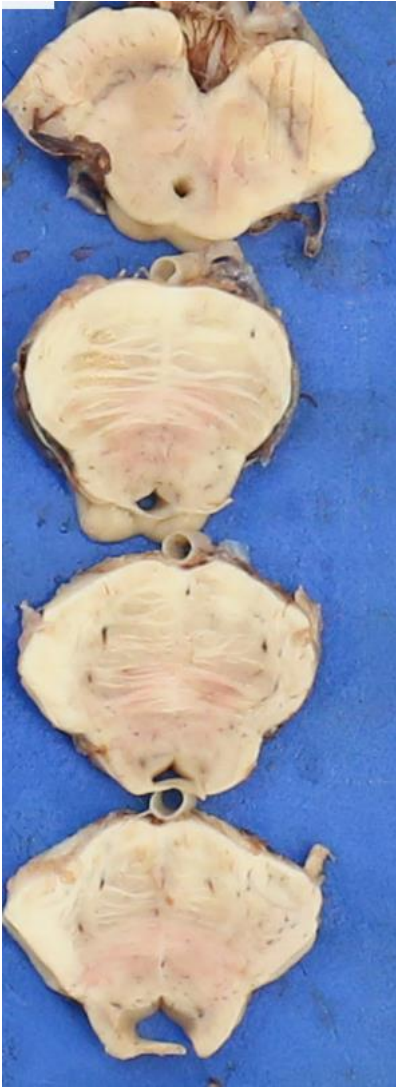


Napoleon's Hat: LGN





AU-21-127

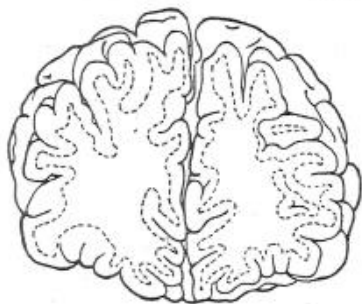






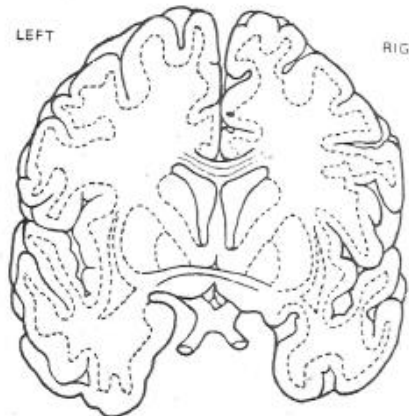
LEFT

RIGHT



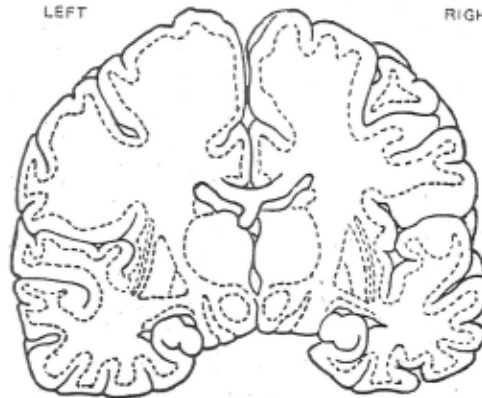
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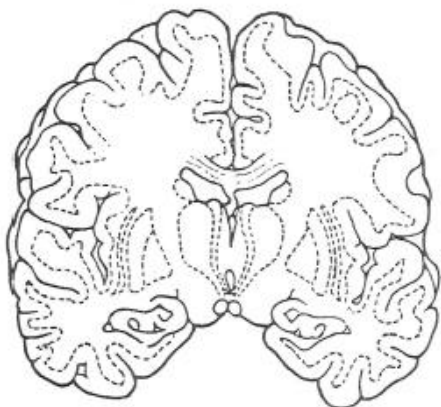
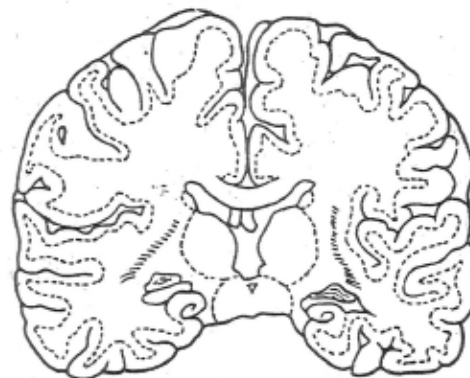
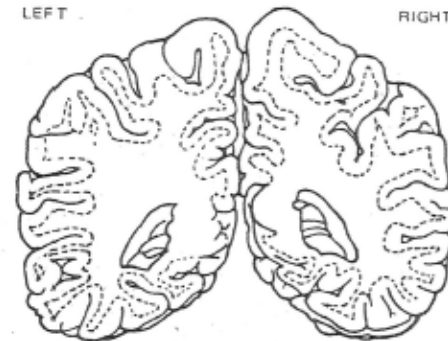
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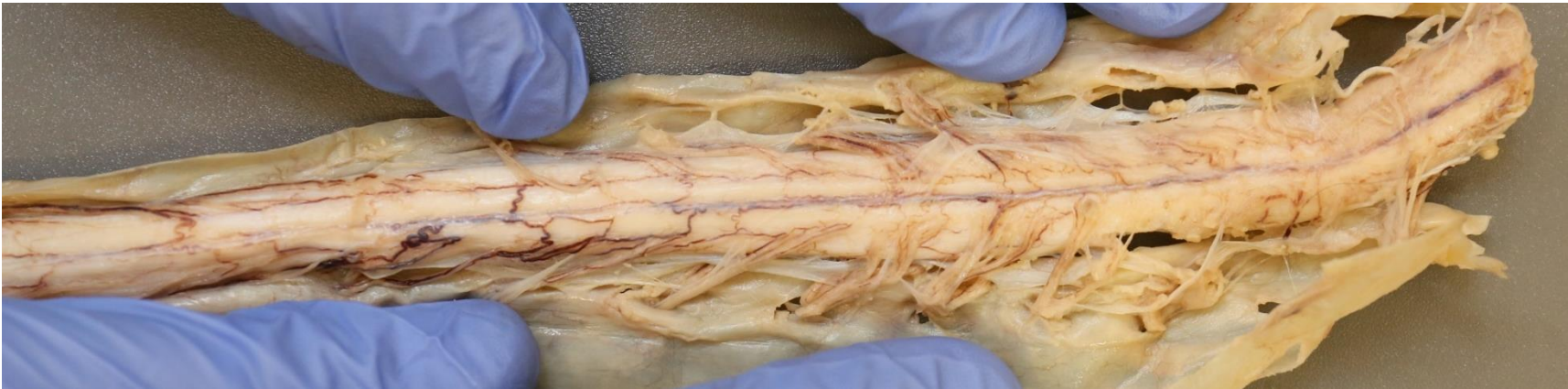


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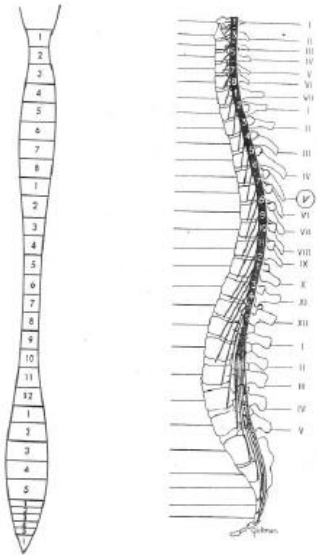
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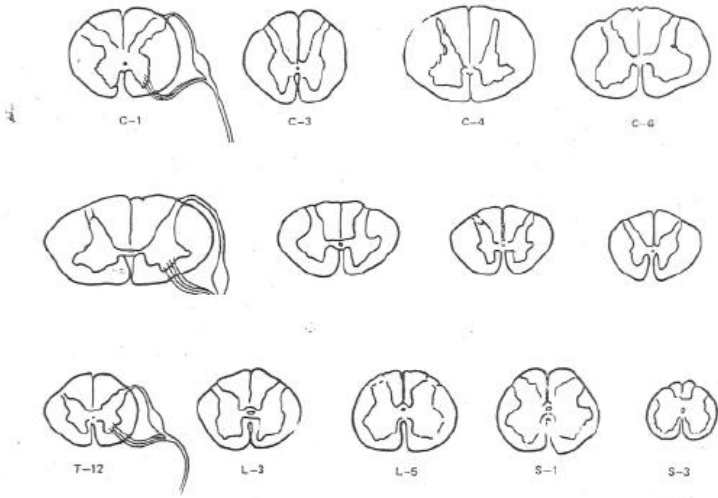




Spinal Cord Levels- External Surface



Cross Sections Spinal Cord

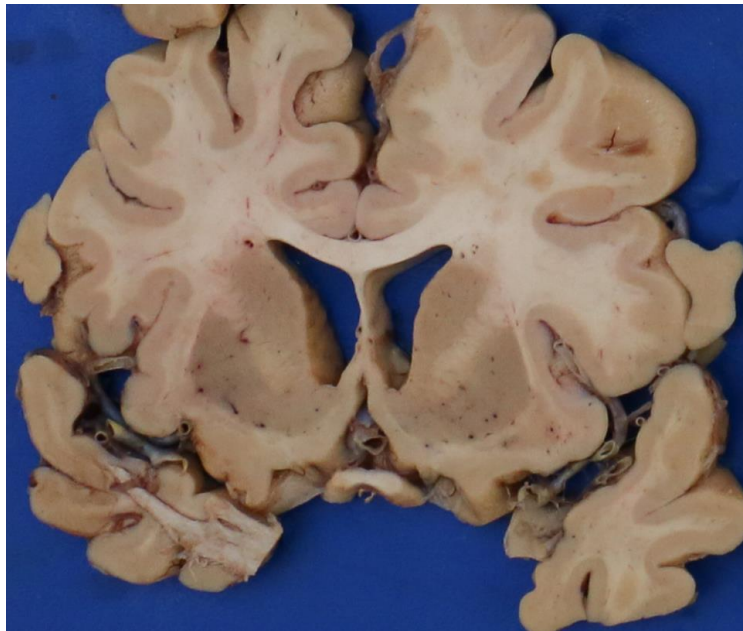
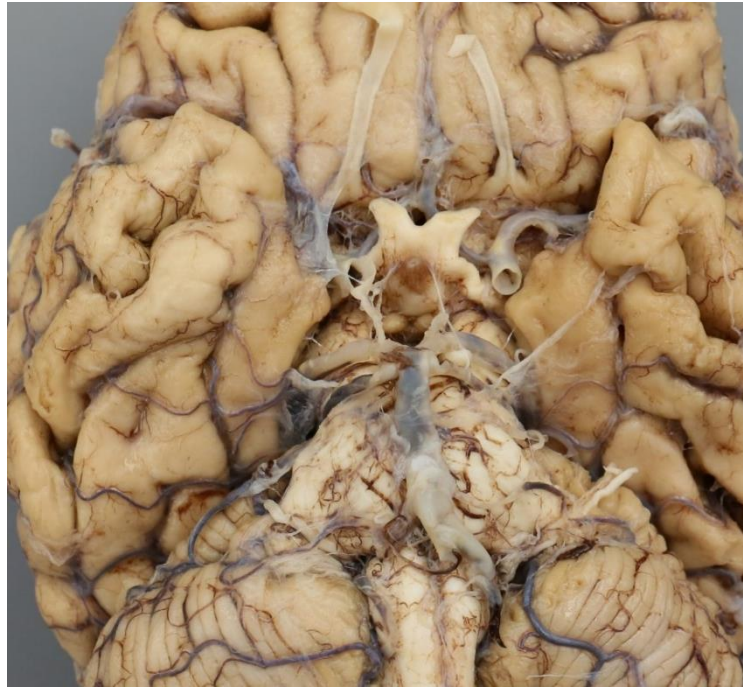




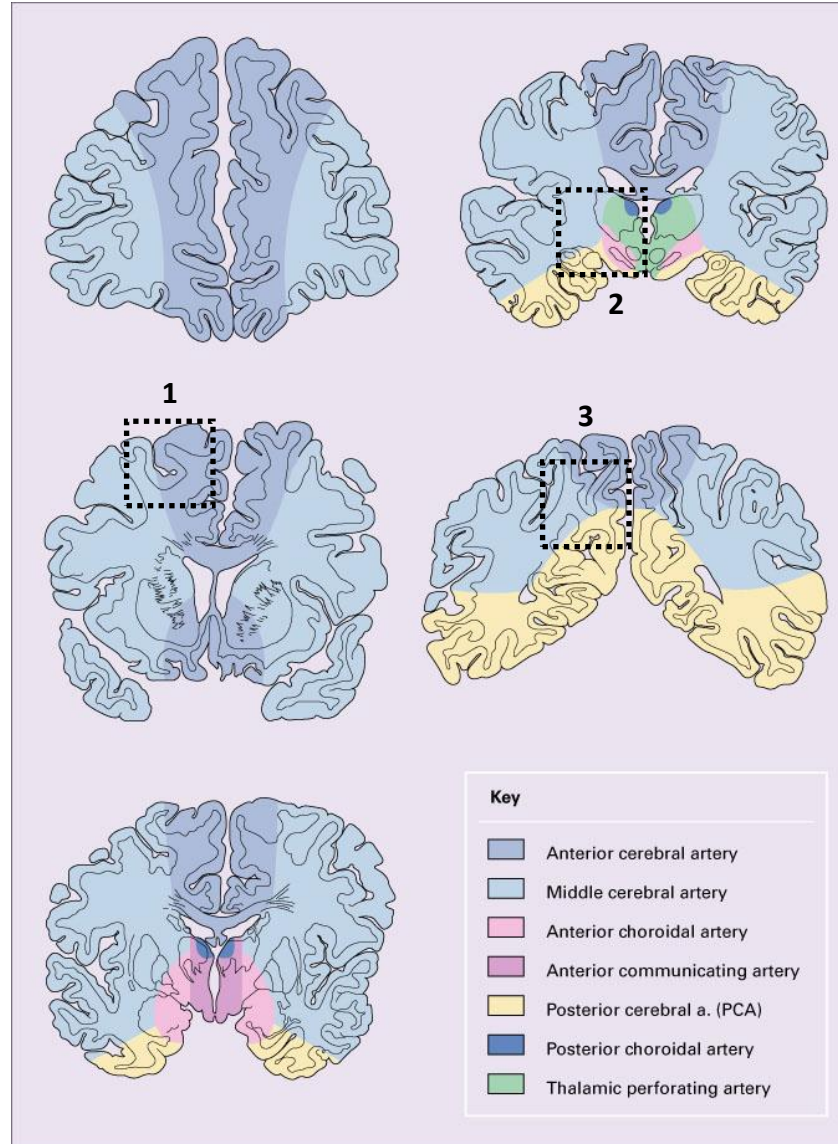
## **Suggested Sections for brain cutting**

1. Include a section of any abnormal brain regions identified at brain cutting.
2. In hypoperfusion/ischemic events, include appropriate watershed areas (2-4 cassettes).
3. If history of alcohol abuse, include a section of superior and inferior cerebellar vermis, mammillary bodies and periaqueductal grey matter.
4. Brains without gross pathology and additional sections for the above-mentioned cases:
  - A. Cerebral cortex (frontal, temporal, parietal OR occipital).
  - B. Basal ganglia.
  - C. Hippocampus at the level of the lateral geniculate (LGN) a.k.a. Napoleon's hat
  - D. A section of brain stem (midbrain, pons and /or medulla)

## Vessels

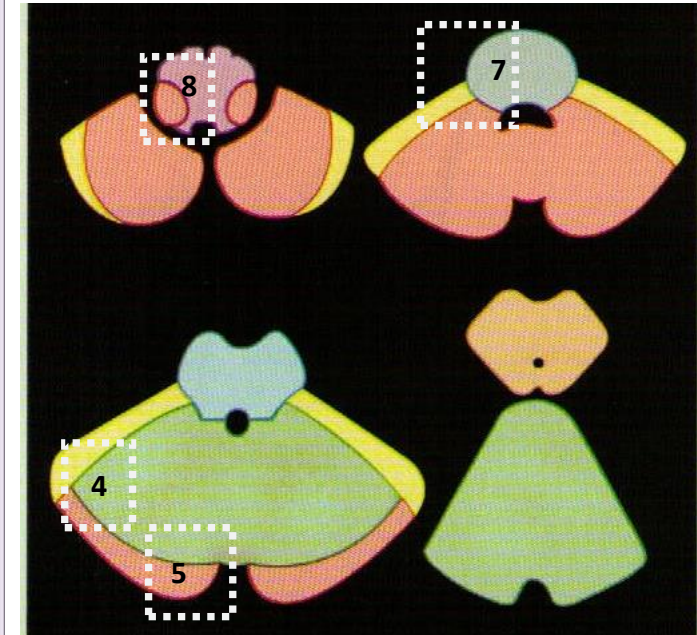


## CNS WATERSHED AREAS (SCP sections)



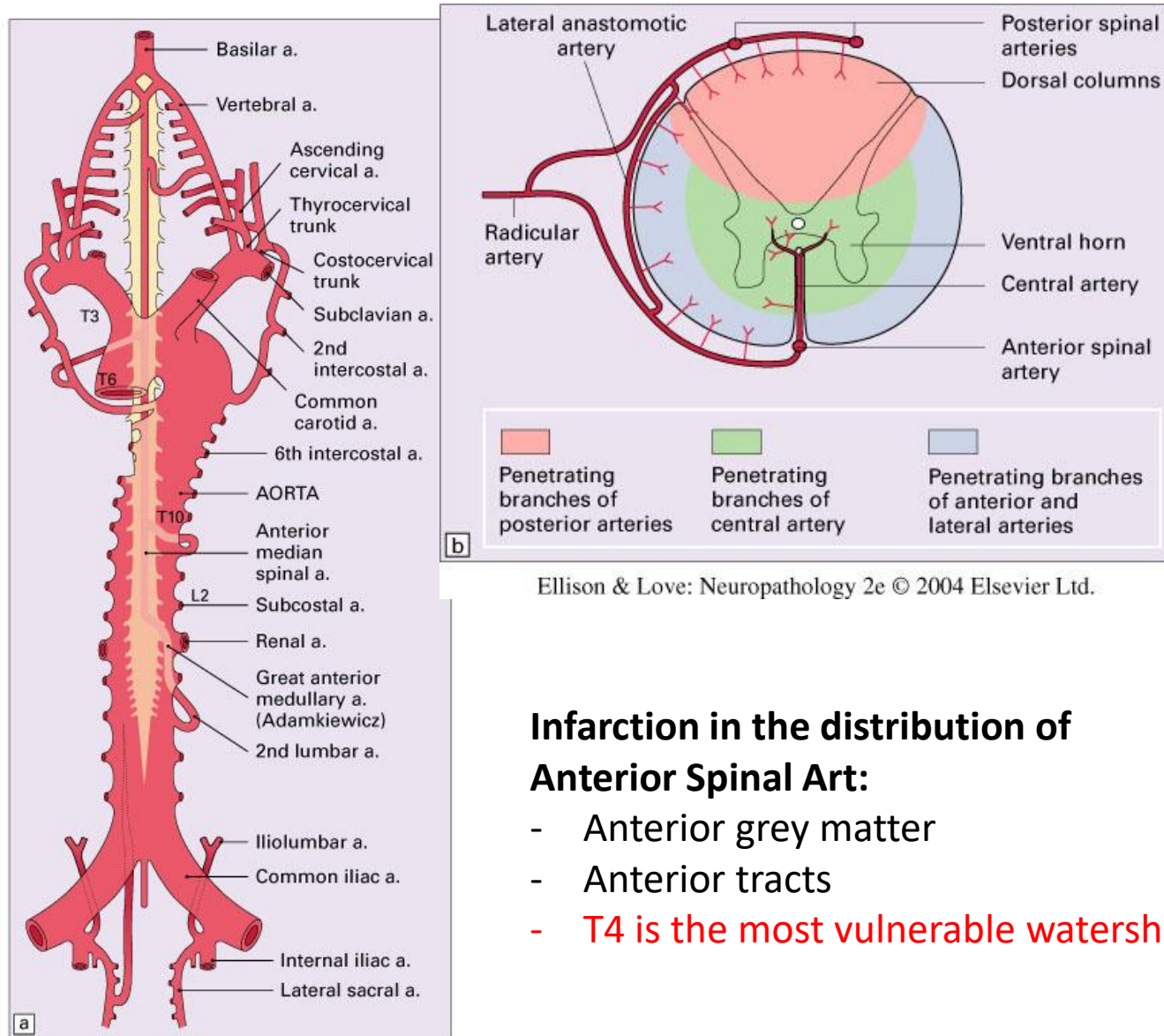
Ellison & Love: Neuropathology 2e © 2004 Elsevier Ltd.

1. Superior and Middle Frontal gyrus at the level of CAP
2. Thalamus, Red nucleus, SN and LGN
3. Medial Parieto-Occipital cortex



- Pontine perforating arteries
- Sup Cerebellar Art
- Antero Inferior Cerebellar artery
- Postero Inferior Cerebellar artery
- Medullary Perforating arteries

4. Cerebellar hemispheres
5. Cerebellar vermis
6. Pons
7. Medulla



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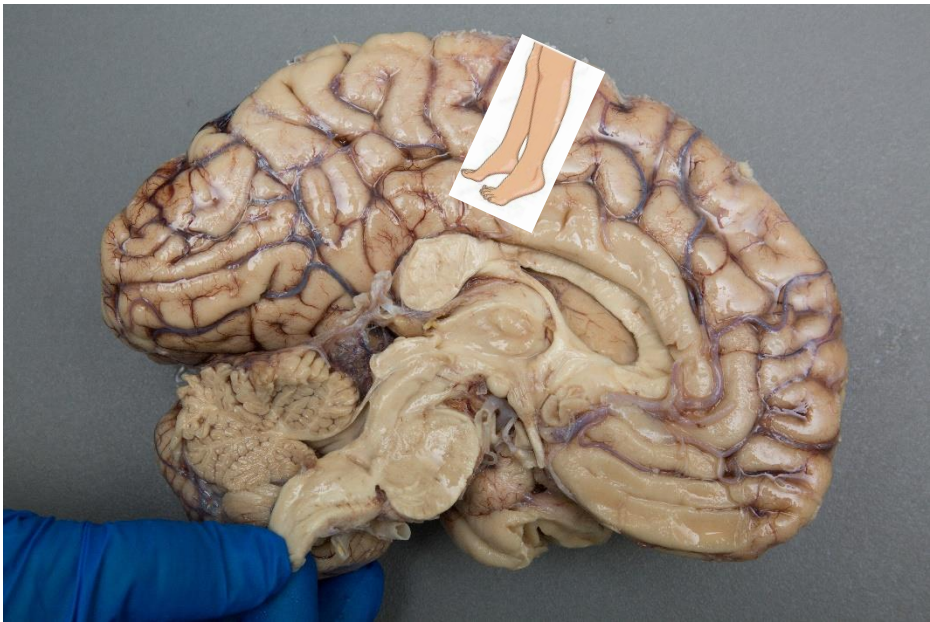
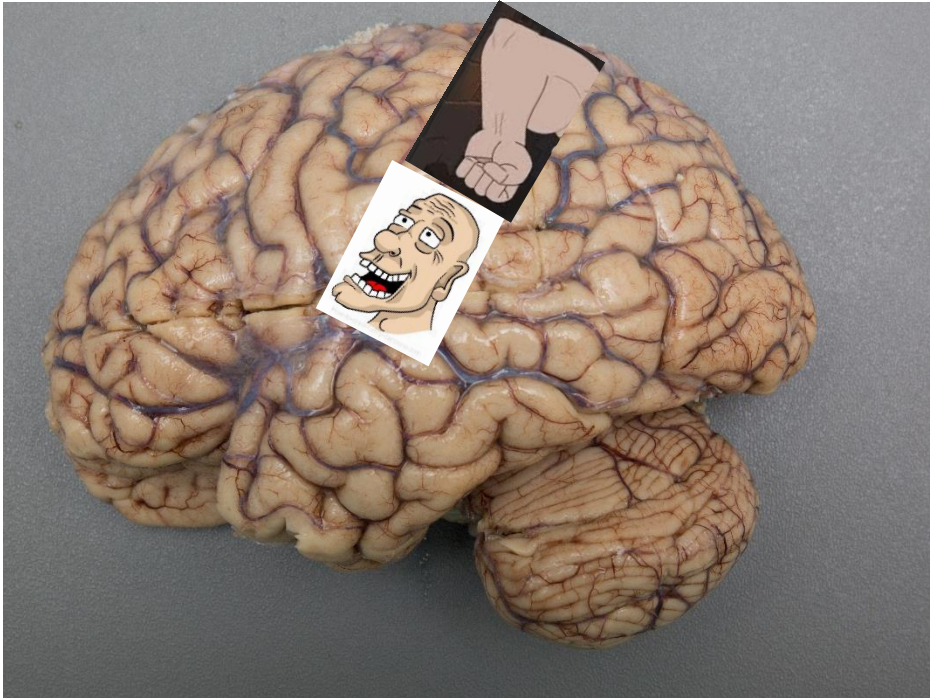
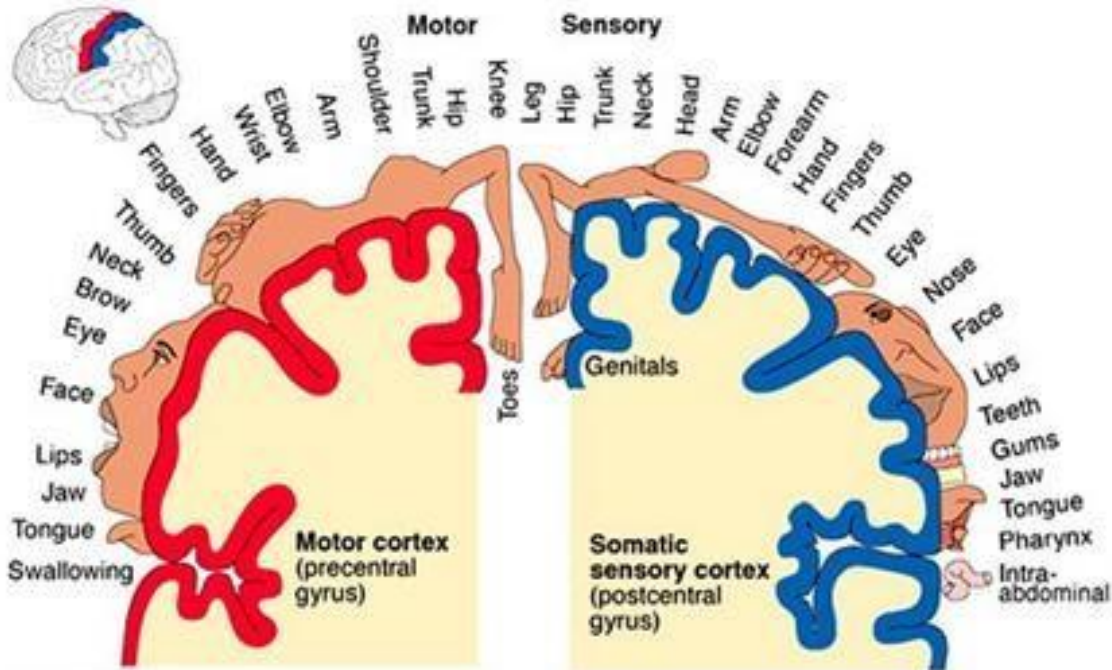
## Infarction in the distribution of Anterior Spinal Art:

- Anterior grey matter
- Anterior tracts
- T4 is the most vulnerable watershed area

Ellison & Love: Neuropathology 2e © 2004 Elsevier Ltd.



# HOMUNCULUS



# Brain Gross Description Template

In Soft **Ctrl+A: AUB**

The brain weighs <New Edit Field> g **Fix/Fresh** (normal range: 1200 - 1400 g). Both the external and internal surfaces of the dural leaflets are smooth and free from nodules. The superior sagittal sinus is **patent**. There **is /is no** evidence of cingulate, uncus, or cerebellar tonsillar herniation. The leptomeninges are **(thin, translucent, and free from exudates or cloudy)**. Examination of the arteries of the circle of Willis and their major branches reveals they are patent with **mild/moderate/severe** atherosclerosis. Aneurysms **are/are not** seen. The superficial veins of the brain and cranial nerves are unremarkable. There **is/is no** atrophy primarily affecting the <New Edit Field> lobes. After coronal sectioning, the cerebral hemisphere reveals a cortex of <New Edit Field> mm at the level of the genu of the corpus callosum. The lateral ventricle **is/ is not** dilated. The septum pellucidum is **unremarkable**. The centrum semi-ovale is **(free from hemorrhage and tumor mass)/or has XXX lesions**. The central nuclei of the brain, including caudate, globus pallidus, putamen, thalami, lateral geniculate bodies and subthalamic nuclei all are **unremarkable**. The hippocampus and amygdala are **Select One**. The substantia nigra and locus ceruleus are **Select One**. The remainder of the midbrain, pons, medulla, cerebellar hemispheres, vermis and cerebellar nuclei are <New Edit Field>. The spinal cord is <New Edit Field> OR not available for examination.

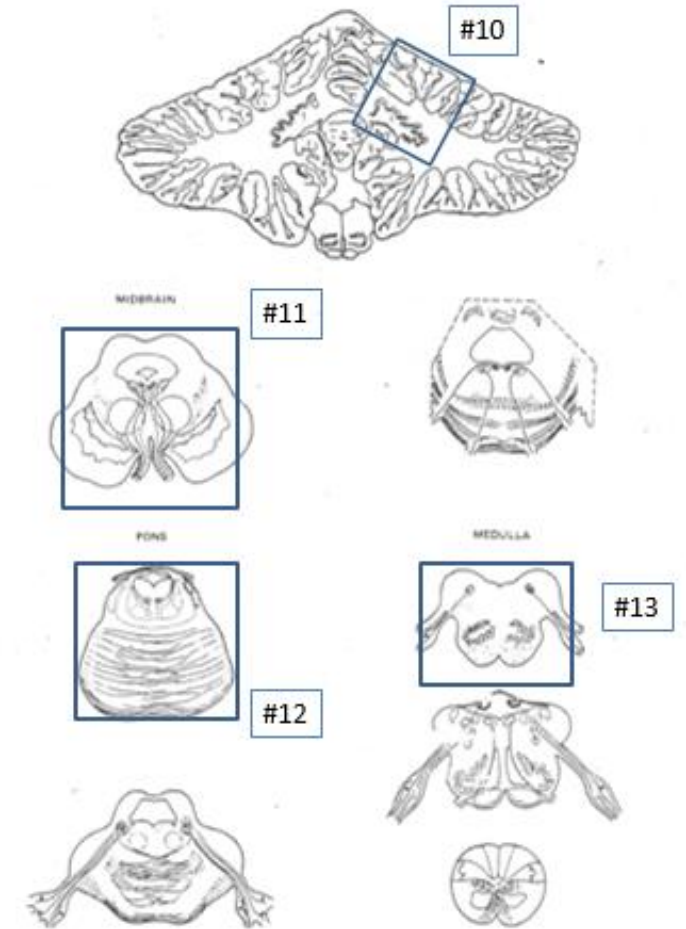
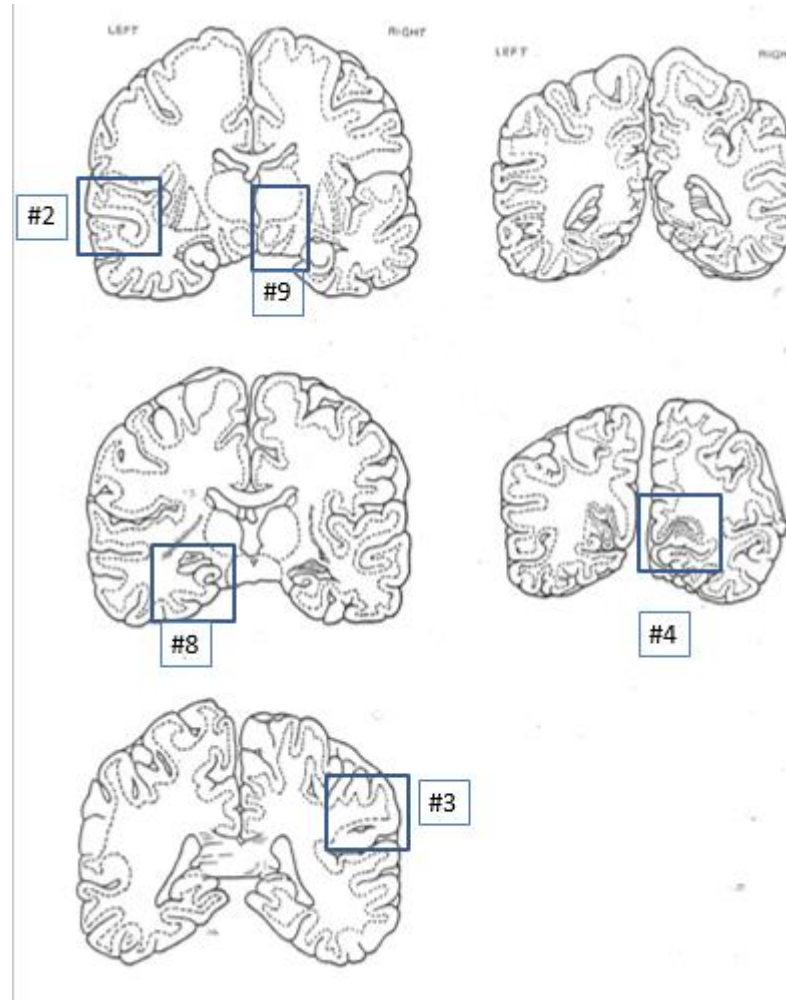
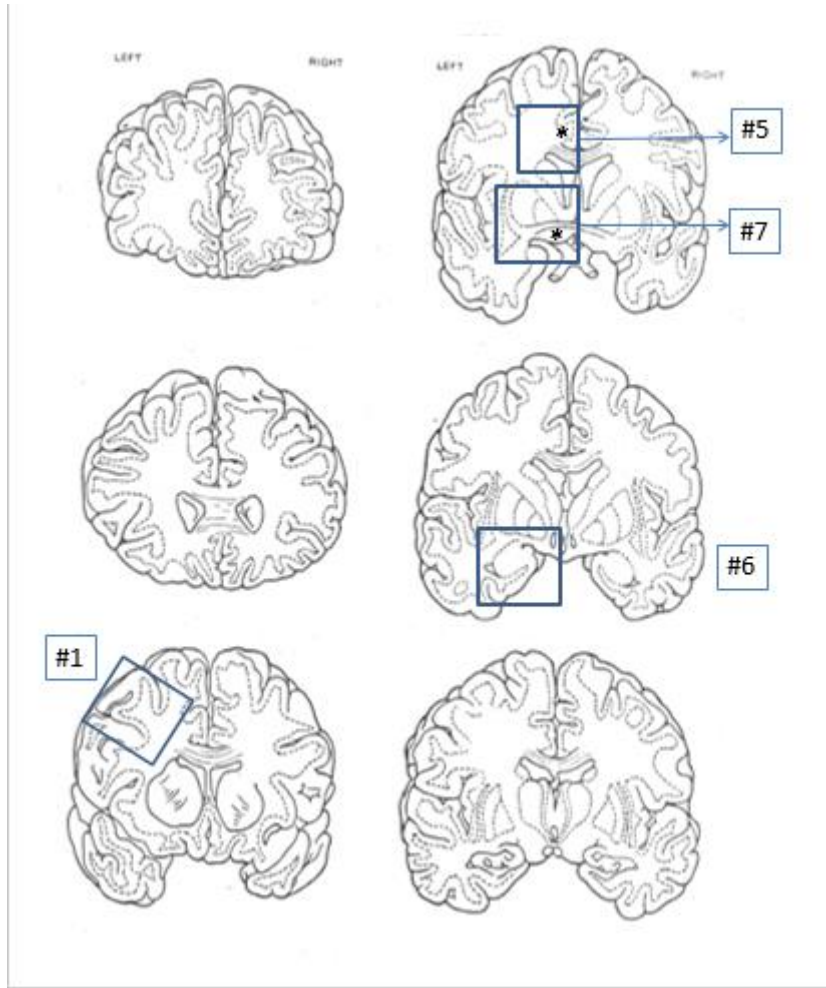


## Sections for Neurodegenerative Cases

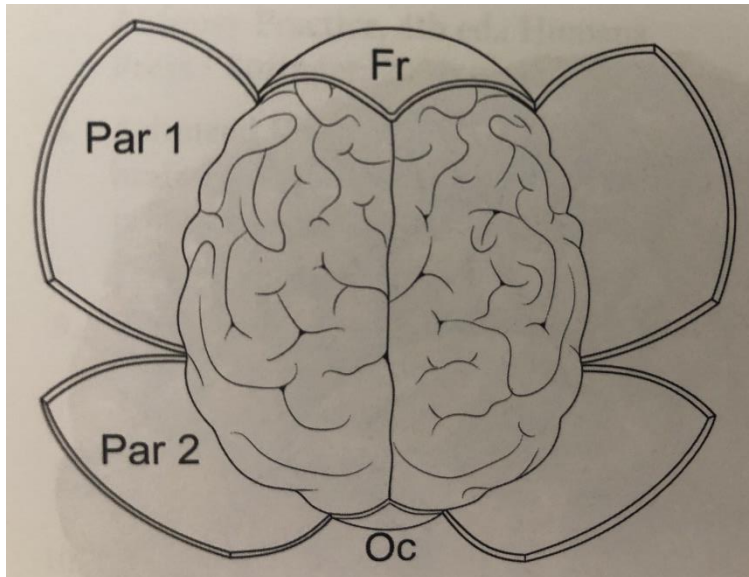
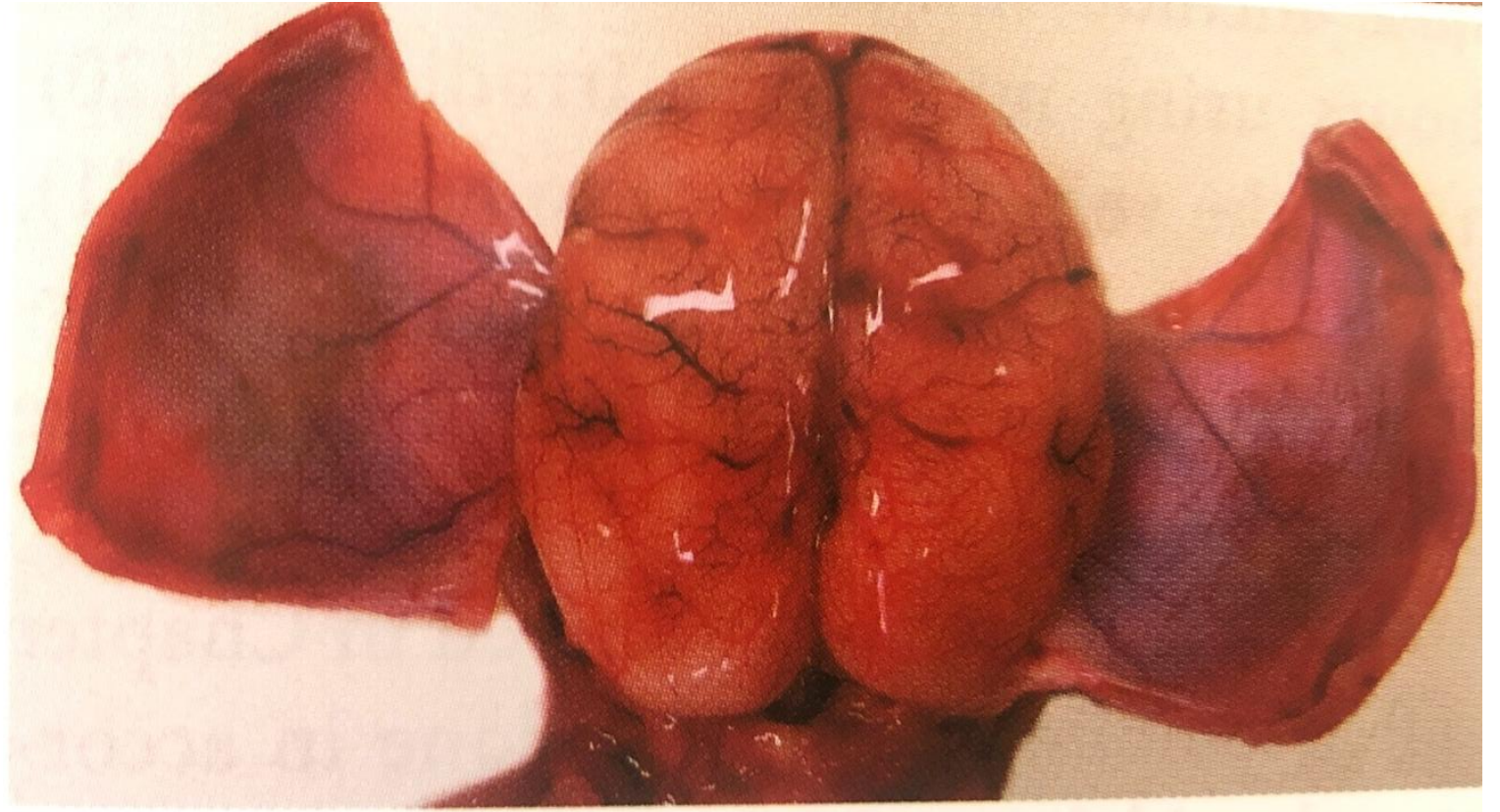
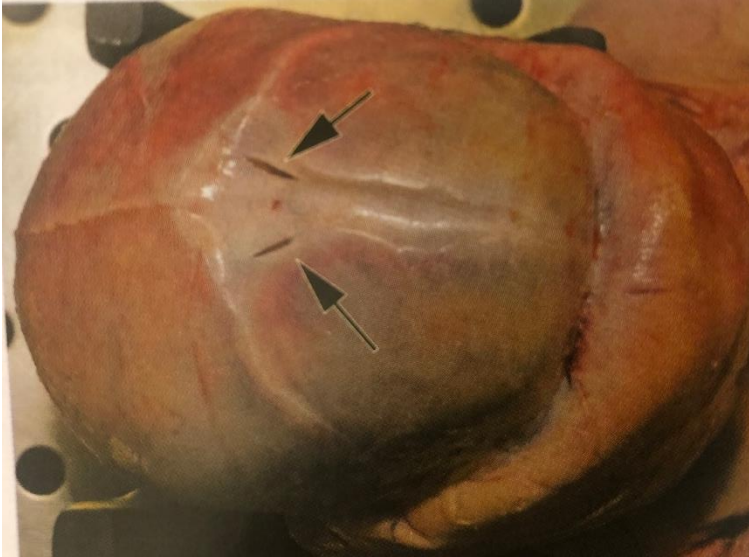
1 Middle Frontal Gyrus
2 Superior and Middle Temporal Gyrus
3 Inferior Parietal Cortex
4 Occipital, Primary Visual Cortex
5 Anterior cingulate with corpus callosum
6 Amygdala
7 Nucleus basalis at the level of anterior commissure. Include Basal Ganglia GP and Putamen

8 Hippocampus at the level of the lateral geniculate
9 Subthalamic nucleuses and Thalamus
10 Superior cerebellum with full dentate nuclei
11 Midbrain at the level of the red nucleus
12 Pons one section with basis pontis and 1 or 2 additional levels of locus ceruleus
13 Medulla at the level of inferior olivary nucleus

# Sections for Neurodegenerative Cases

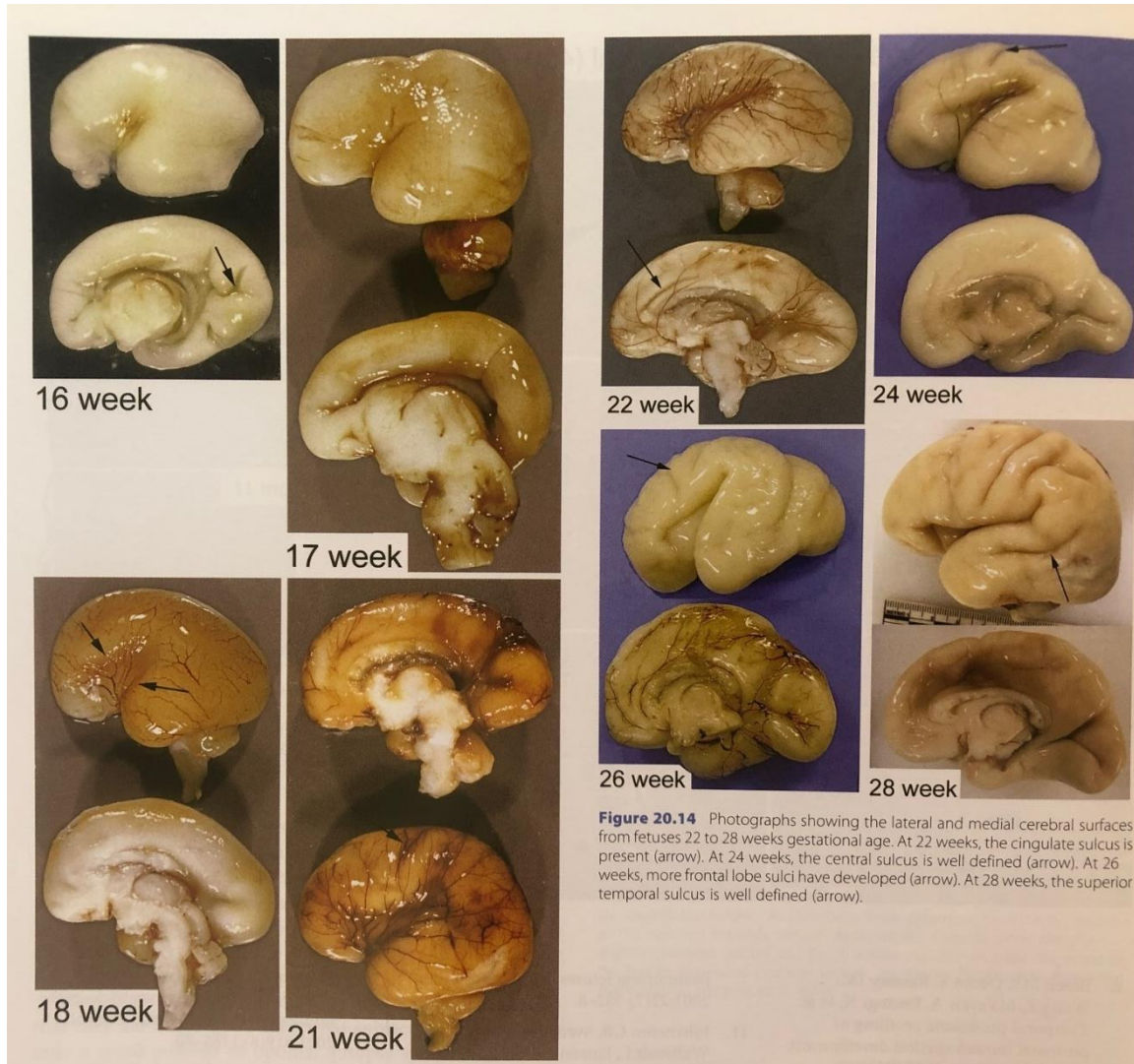


# Brain Removal Perinatal

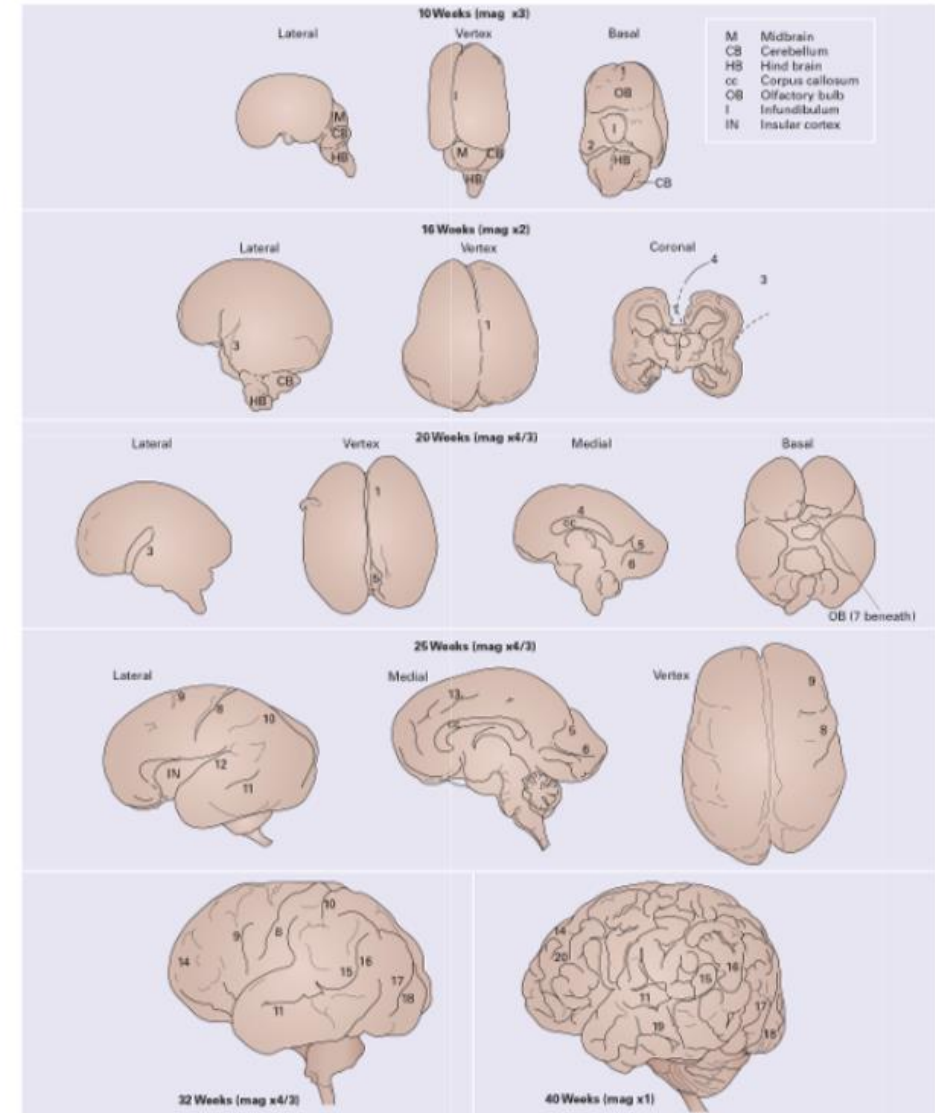




# Perinatal/ Infant Brains

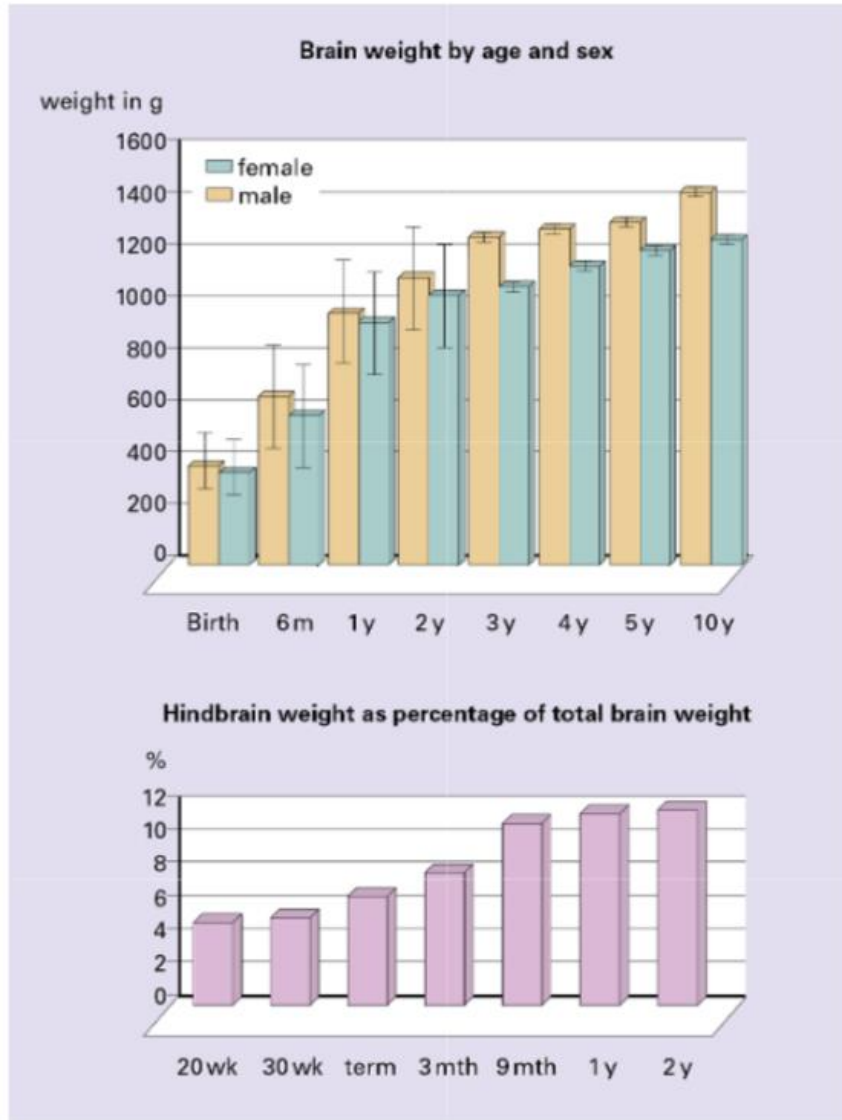


Perinatal Neuropathology  
Cambridge University Press



Neuropathology 3<sup>rd</sup> Ed  
Elsevier

# Perinatal/ Infant Brains

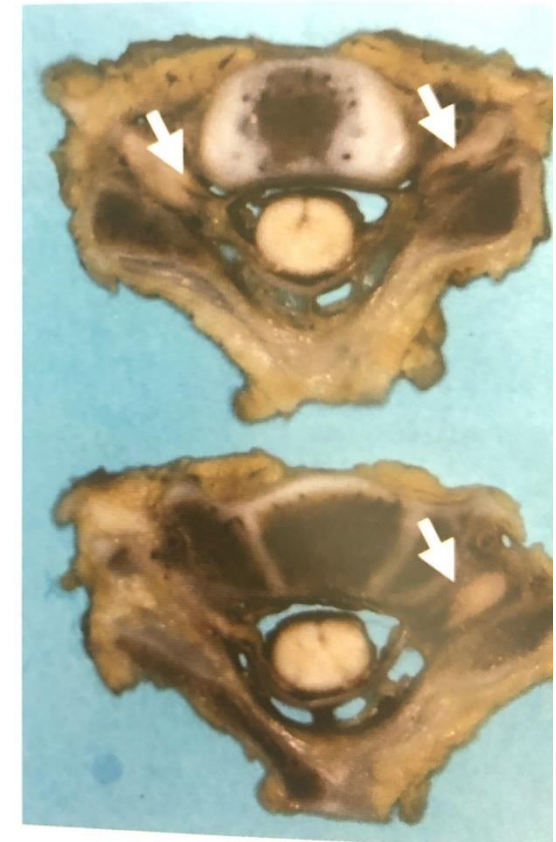


Neuropathology 3<sup>rd</sup> Ed  
Elsevier



**Figure 10.4** A. Vertebral en bloc specimen, dorsal aspect, here including skull at top, cervical and rostral thoracic vertebrae.

B. If child abuse is suspected remove the cervical spinal cord on block with the spine



Perinatal Neuropathology  
Cambridge University Press



# Neuropathology Resources

Camelo-Piragua


Basic Neuropathology Curriculum 2021

<https://www.dropbox.com/sh/h5q4qdyg1desb69/AA CfDf-chRz1MHxZhB6w1Cf2a?dl=0>

LabPortal:

Scanned slides >20,000 Neuropathology slides

[https://labportal.med.umich.edu/portal/apps/tumor\\_boards/search](https://labportal.med.umich.edu/portal/apps/tumor_boards/search)

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Applications ▾ Help ▾

[Home](#) Search

Accession	Stain	Organ	Species
<input type="text"/>	<input type="text"/>	<input type="text" value="Brain"/>	<input type="text"/>

☐ Only return results with UM accession number

Search returned 22372 results. Can not display this many results. Please add additional filters.

Venneti

Course Director Neuropathology 858

<http://www.med.umich.edu/digitallab/path858/index.html>

<https://pathology.med.umich.edu/slides/dirView.php?path=/Neuropath858>



## SUGGESTED SCHEDULE

<a href="#">Week 1</a>	Slide 1 Slides 2-8 Slides 9-20	Normal cortex Cerebral vascular disease Infectious diseases (begin)
<a href="#">Week 2</a>	Slides 21-27 Slides 28-37	Continue Infectious diseases Toxic, metabolic, demyelinating diseases
<a href="#">Week 3</a>	Slides 48-50 Slides 51-61 Slides 62-67	Degenerative disease Dementia/degenerative diseases Spinal cord diseases
<a href="#">Week 4</a>	Slides 68-87	Tumors
<a href="#">Slide Collection</a>	Slide collection for this course. Slides 38N-47N are normal reference slides that you might want to refer to as you look at the pathology slides.	