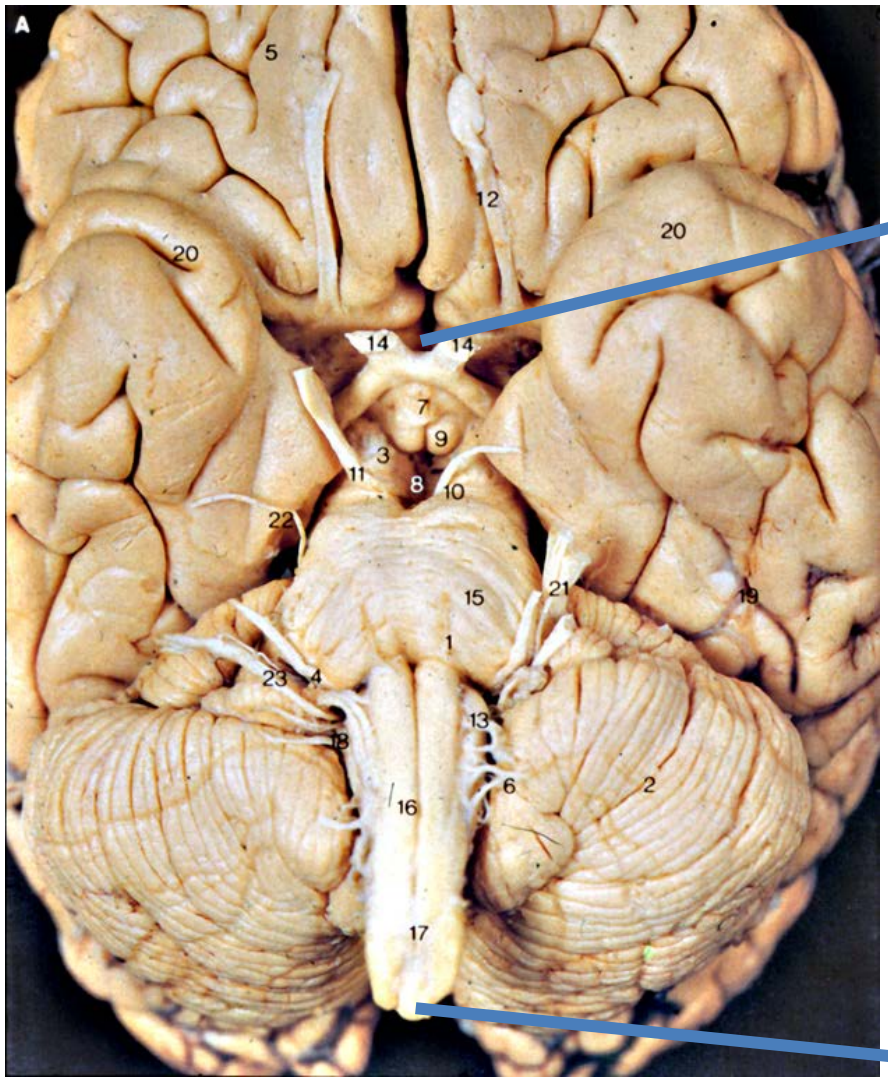
Brainstem

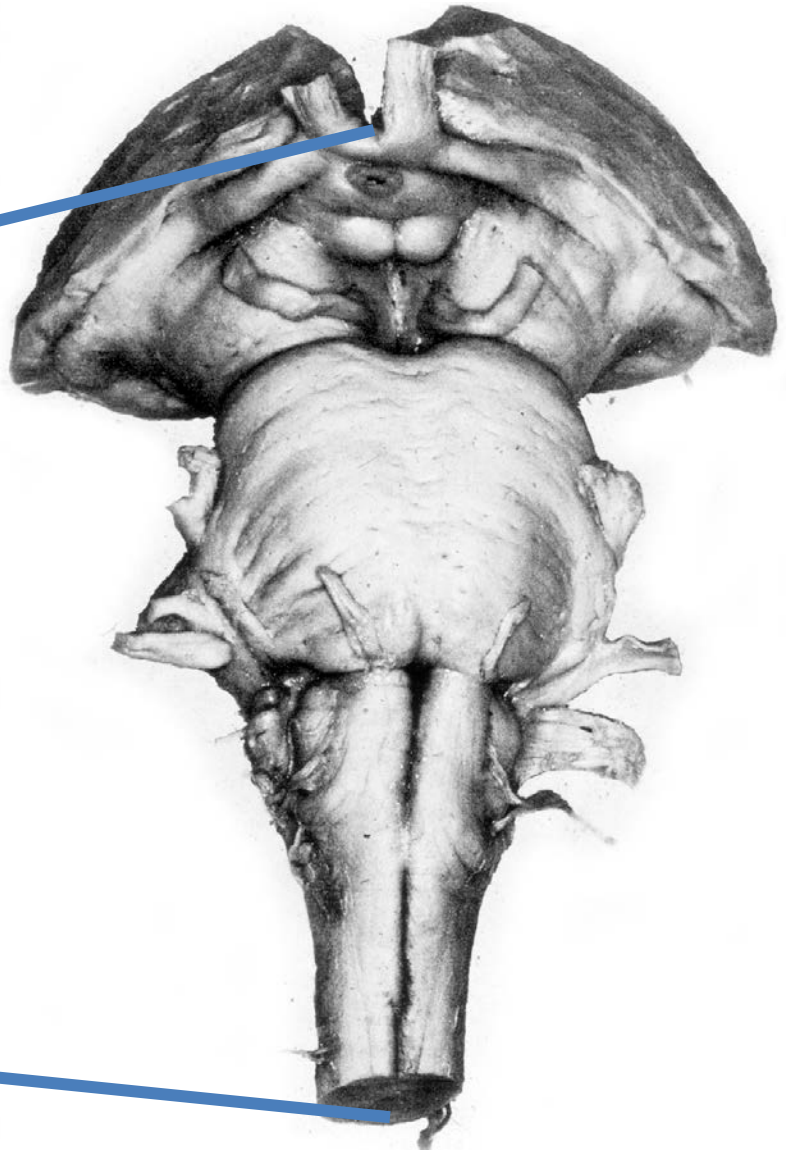
Martin Wessendorf
University of Minnesota
Department of Neuroscience

Goals for today

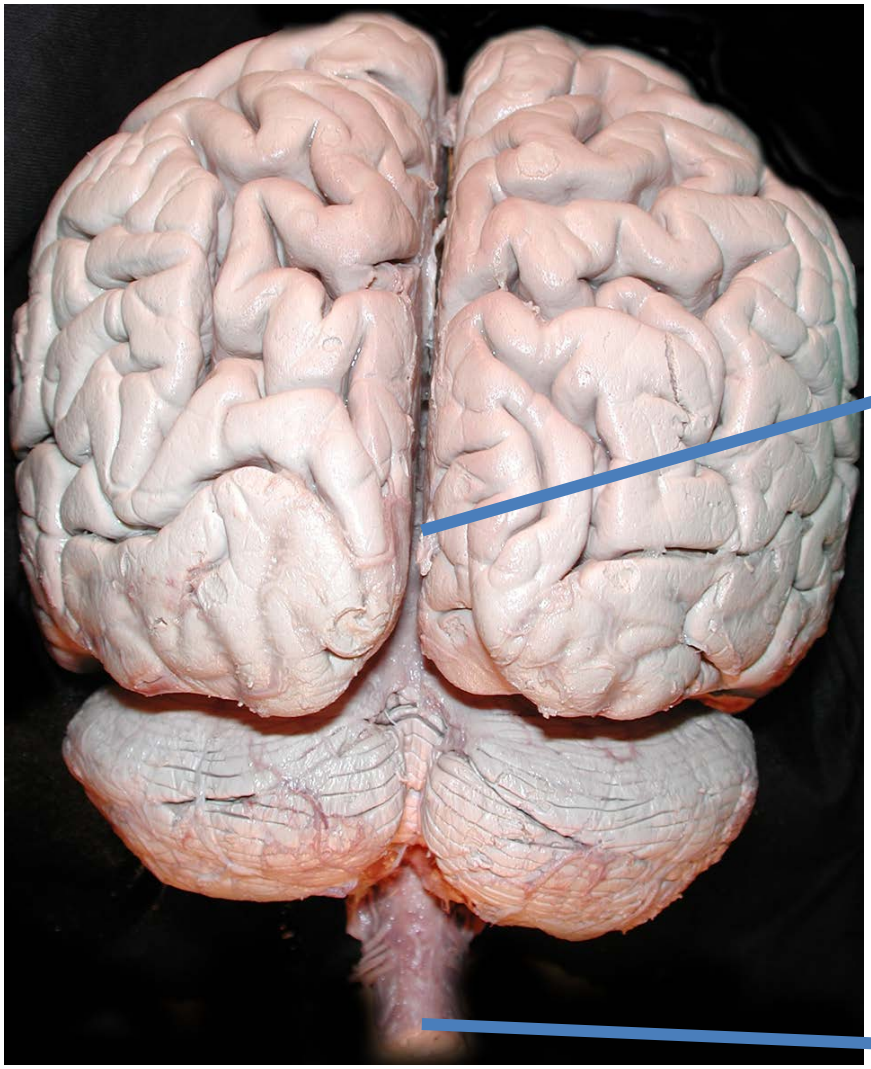
- Learn the major regions of the brain stem
- Learn to identify some of the structures in those regions
- Learn strategies to identify the different regions of the brain stem

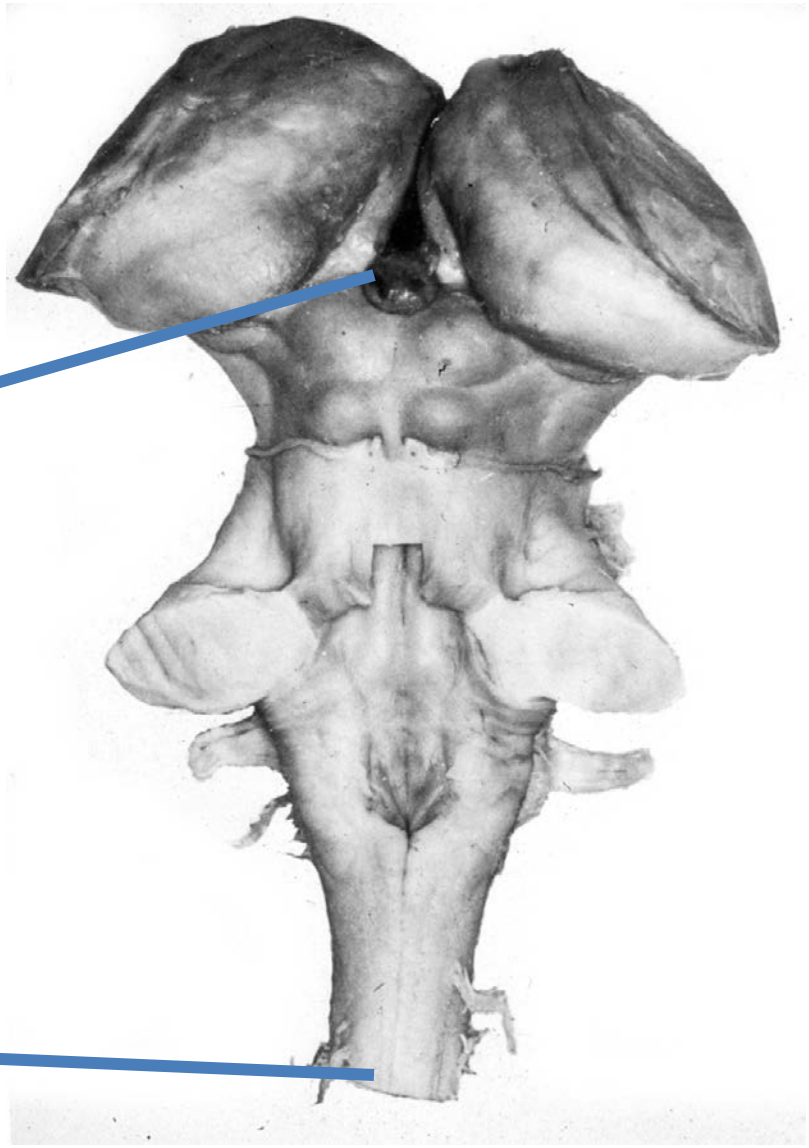
Brainstem: ventral side





Brainstem: dorsal side

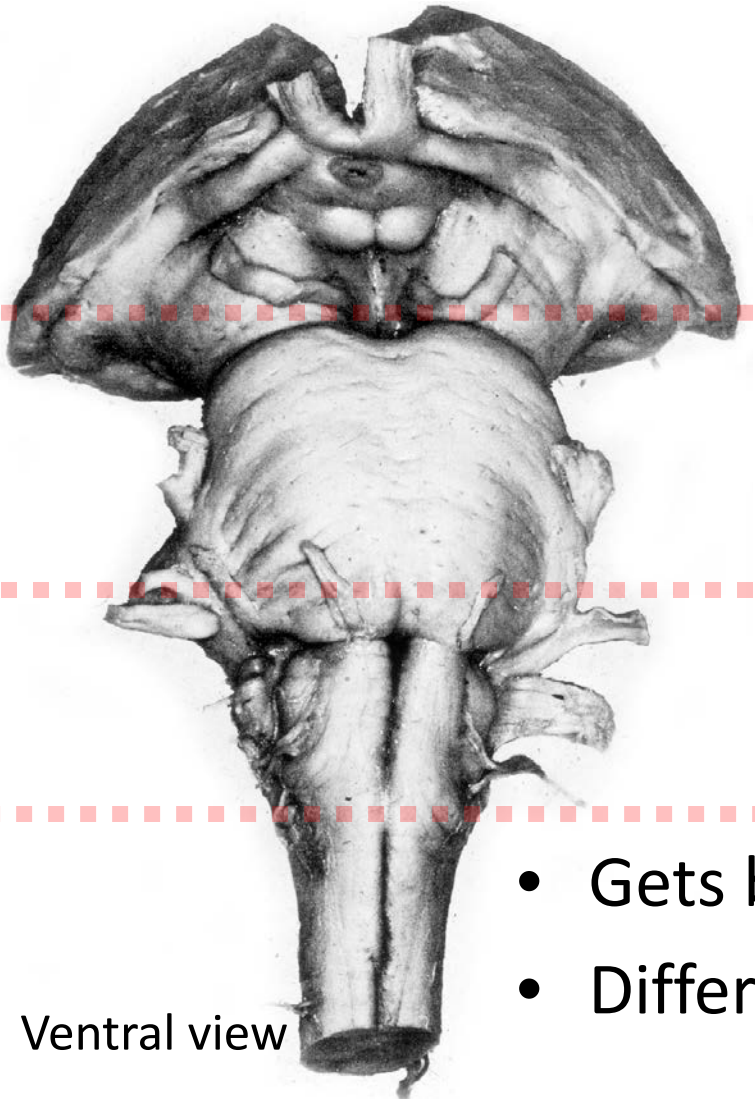




Brainstem

- Evolutionarily old
- Contains cranial nerve nuclei (--Lecture 14)
- Contains tracts that run long distances (e.g., brain to spinal cord)
- Contains circuits innervating many different parts of brain
  - "Reticular formation": involved in sleep and many other functions
  - Includes "monoamine" neurotransmitters
    - Serotonin (5-HT)
    - Norepinephrine (NE)
    - Dopamine (DA)

Brainstem *changes appearance* over its length



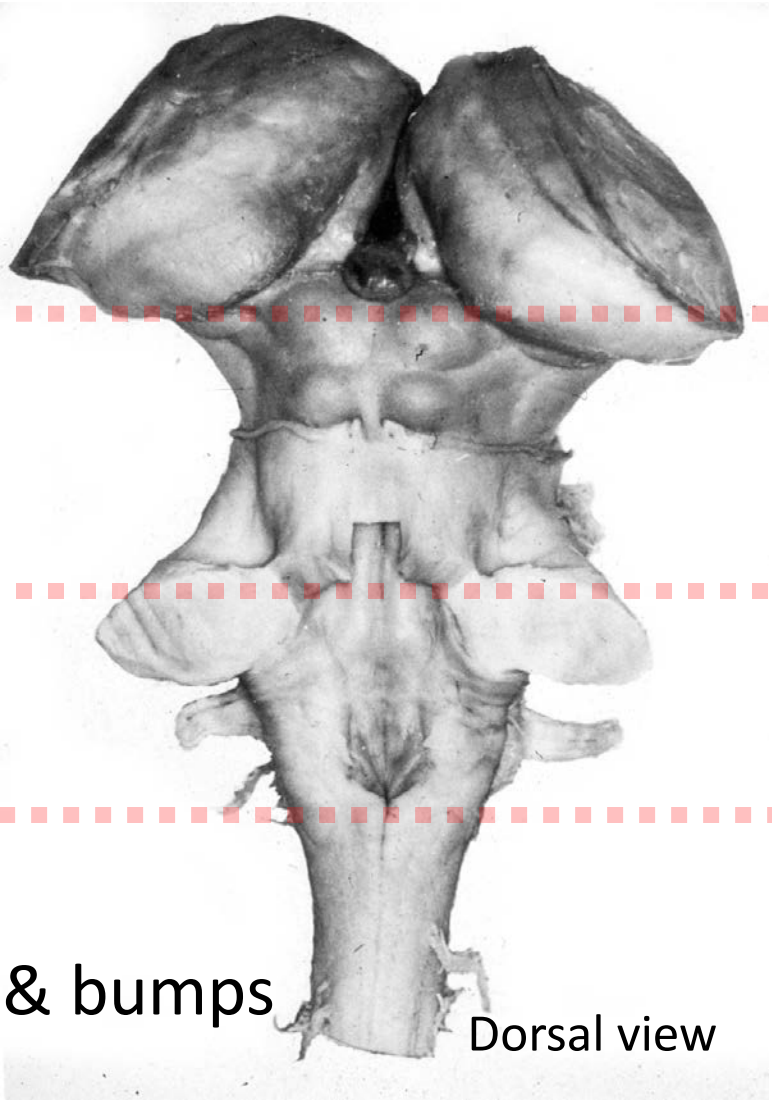
rostral

middle

caudal

- Gets bigger
- Different lumps & bumps

Ventral view



Dorsal view

Why does brain stem change shape?

- Structures get added
- Structures end
- Structures change size
- Fiber (axon) tracts move
  - E.g. start dorsally and end ventrally

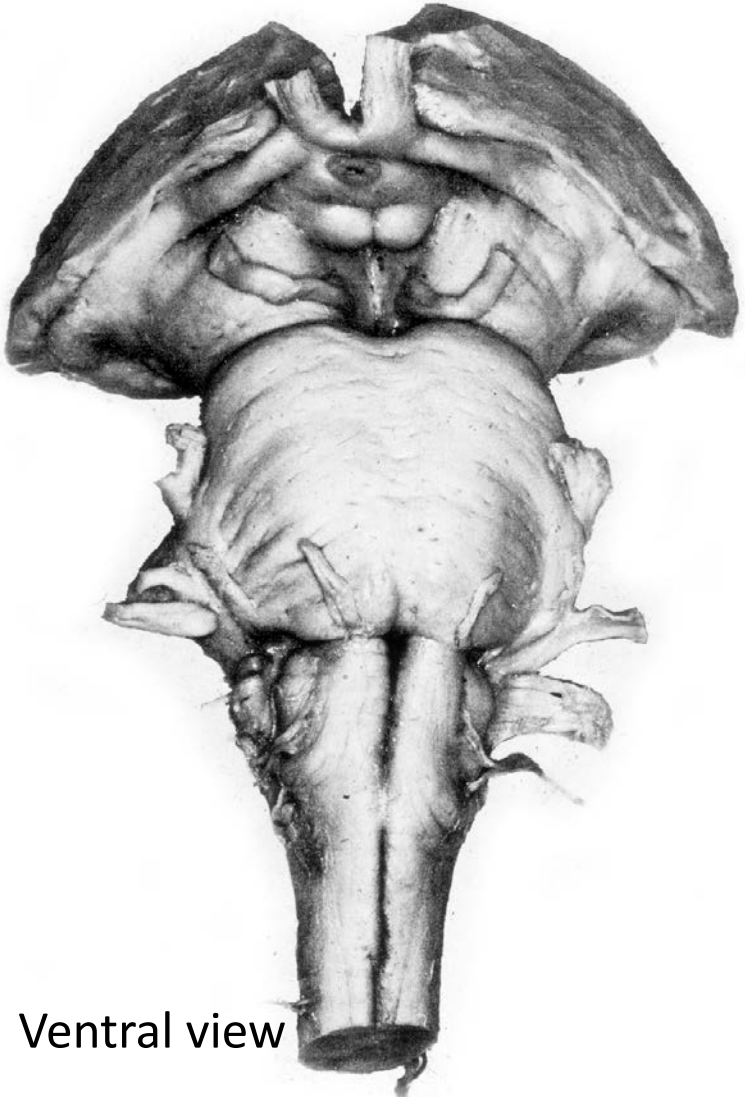
- *Shape changes can reflect changes in function*

- Hint: when comparing brain stem sections, start with the ventricular system—easy-to-find landmark.

One more goal for today: Learn to look at a brain

What features do I see?

Major divisions of brain stem

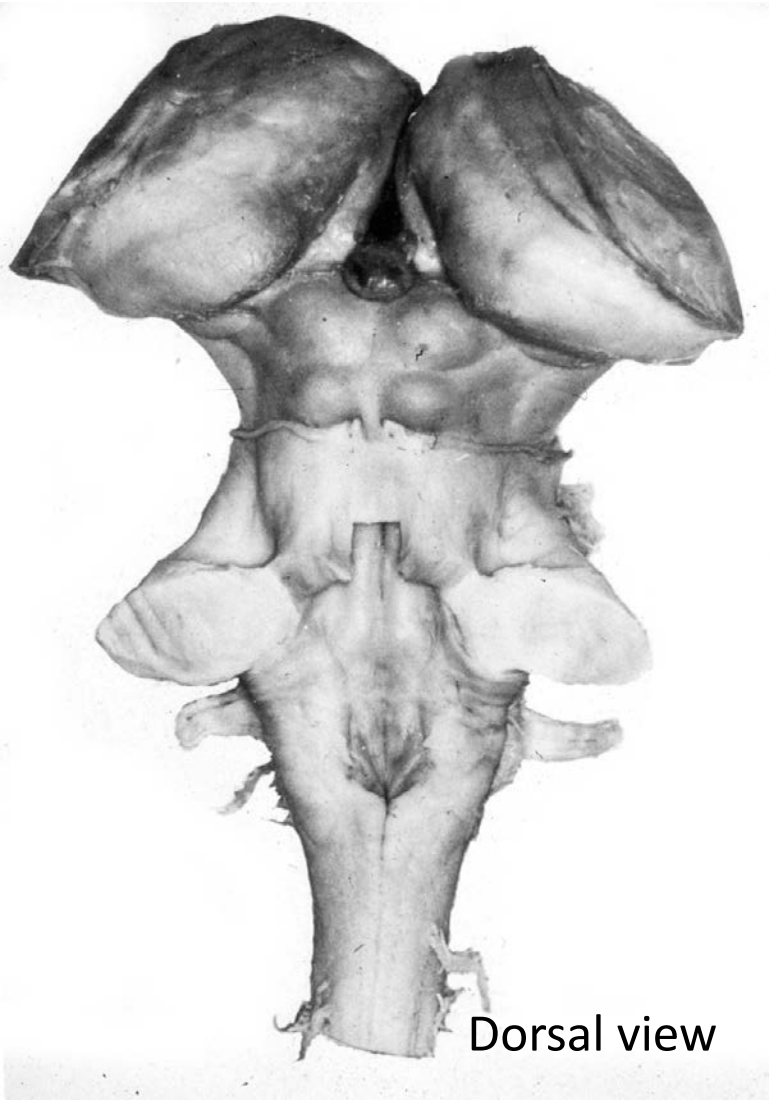


Ventral view

Midbrain

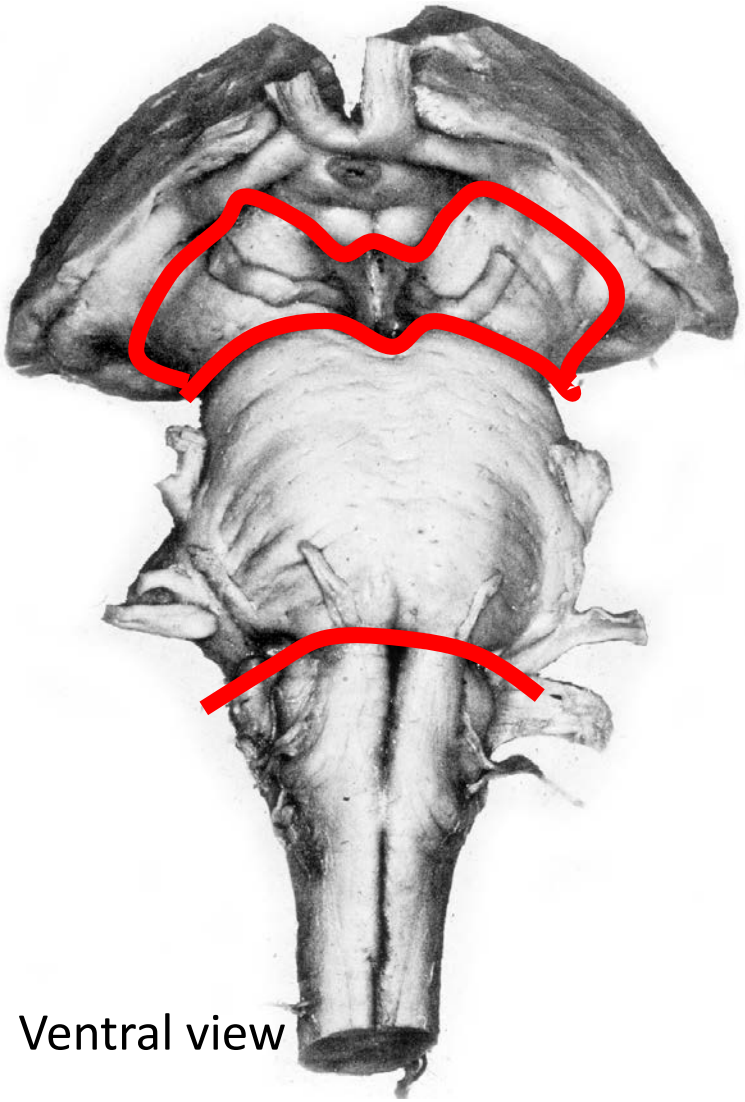
Pons

Medulla



Dorsal view

Major divisions of brain stem

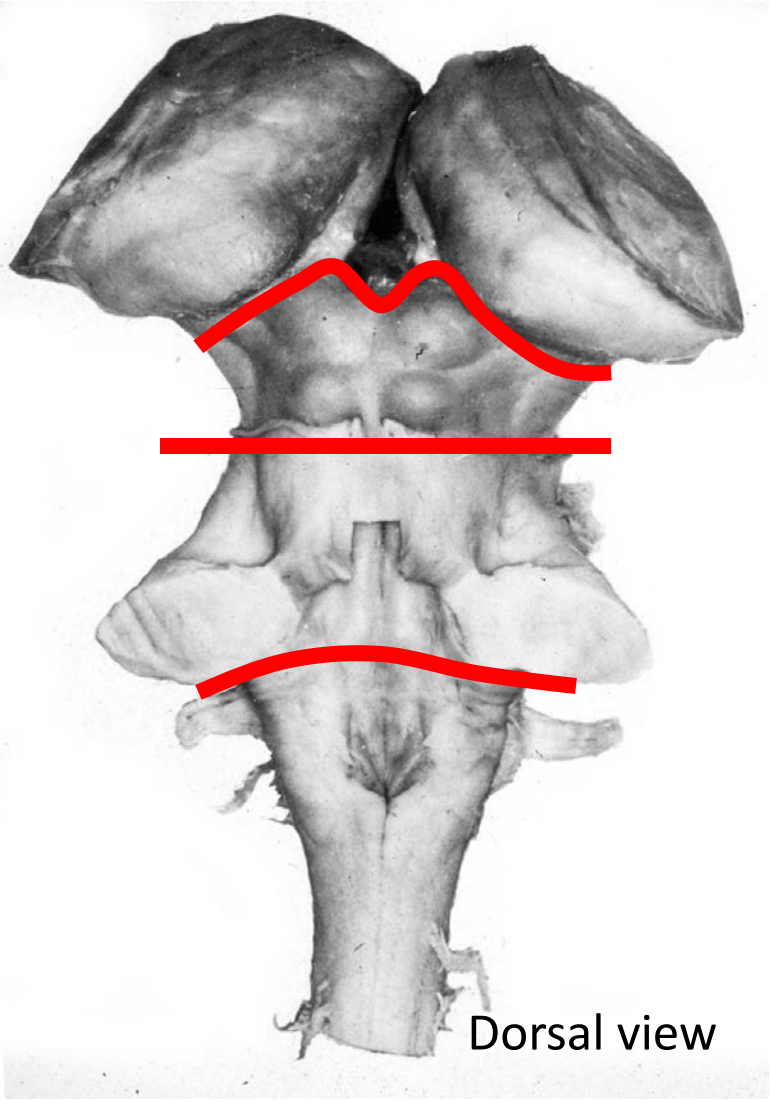


Ventral view

Midbrain

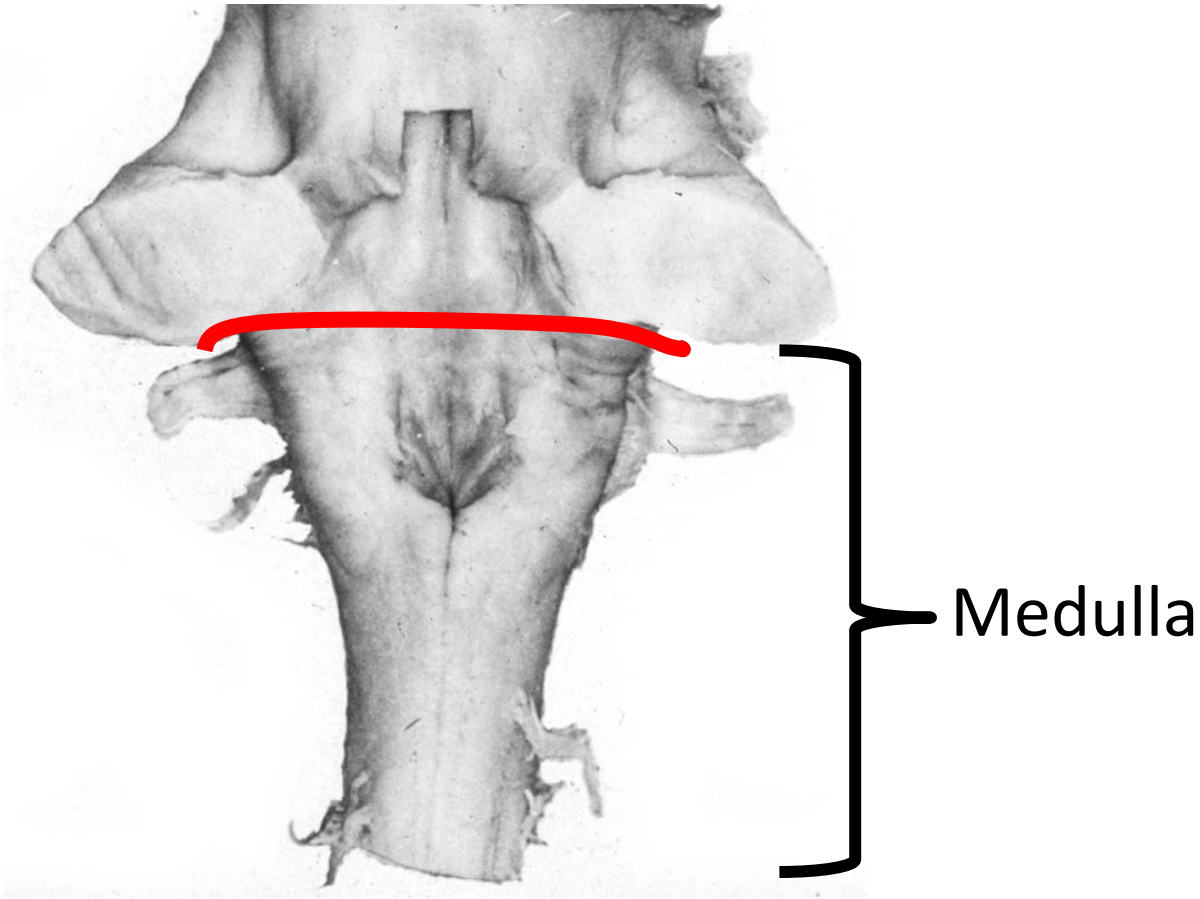
Pons

Medulla

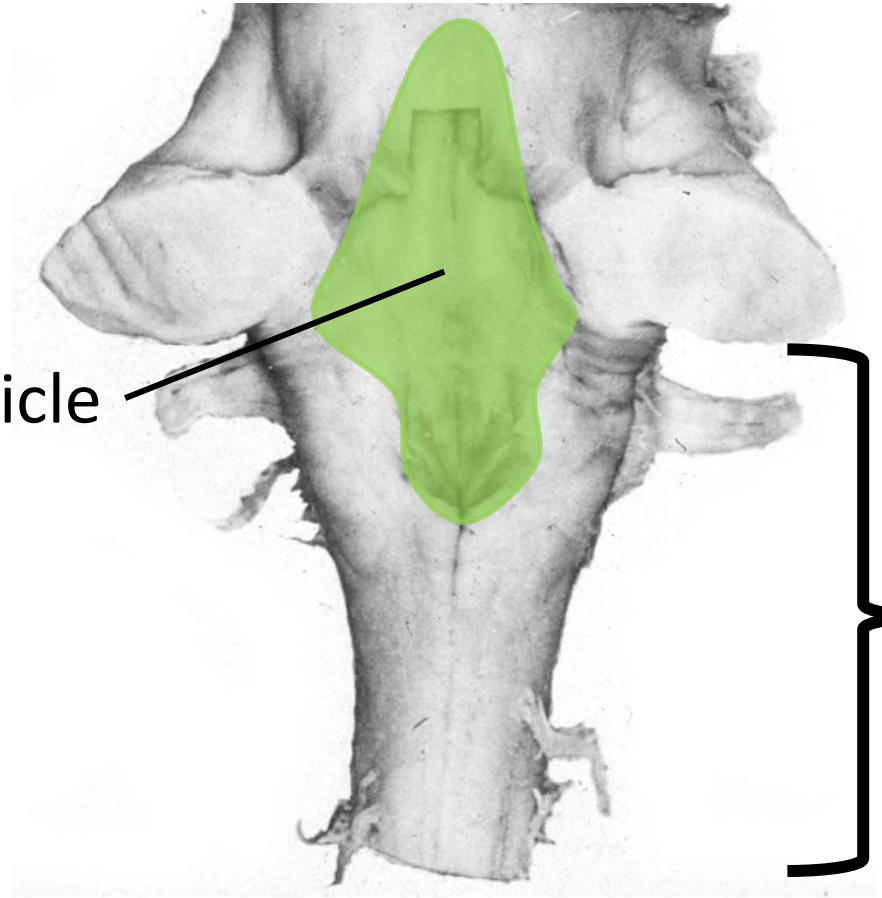


Dorsal view

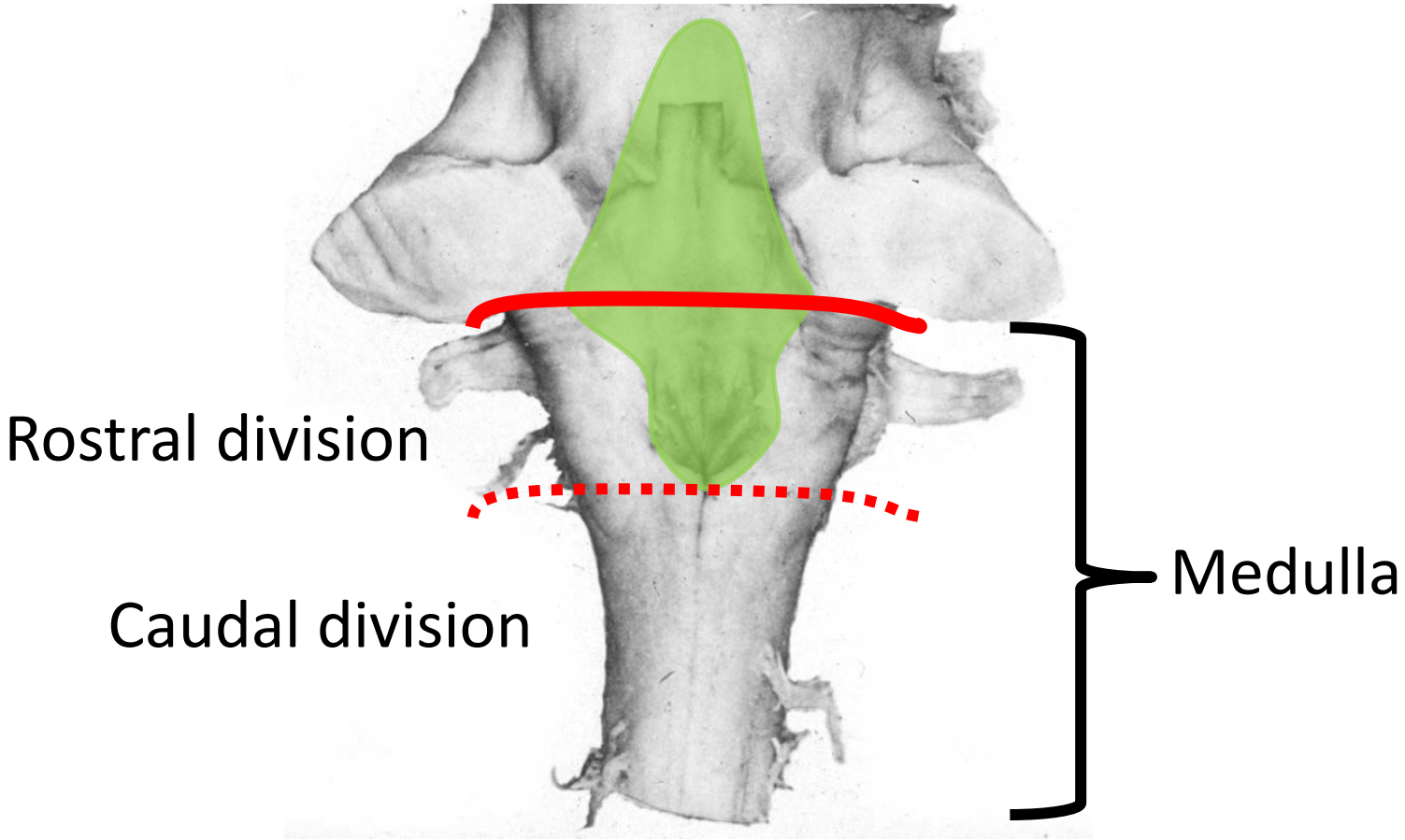
There are caudal & rostral portions of the medulla



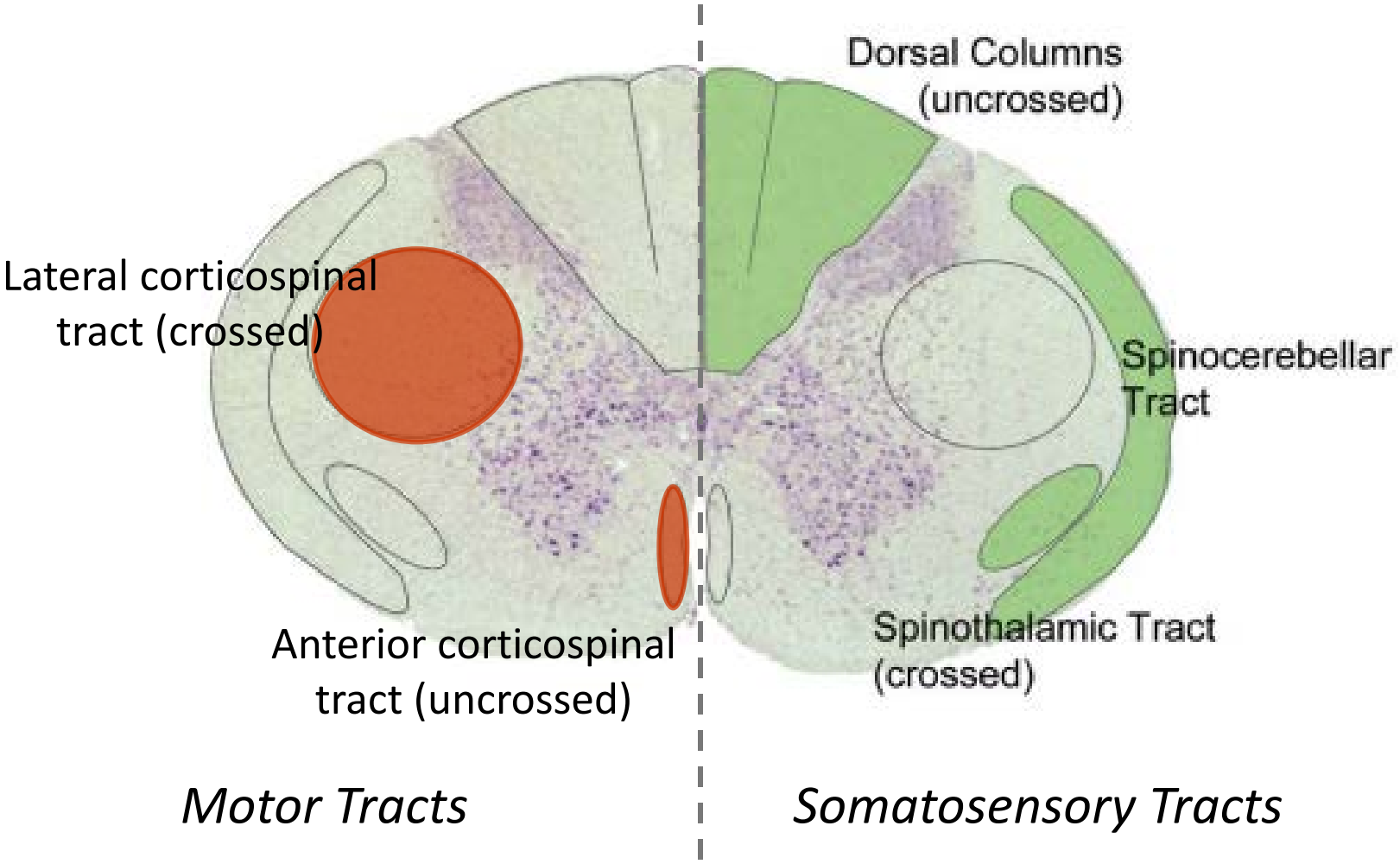
Medulla: rostral half defined by presence of 4th ventricle

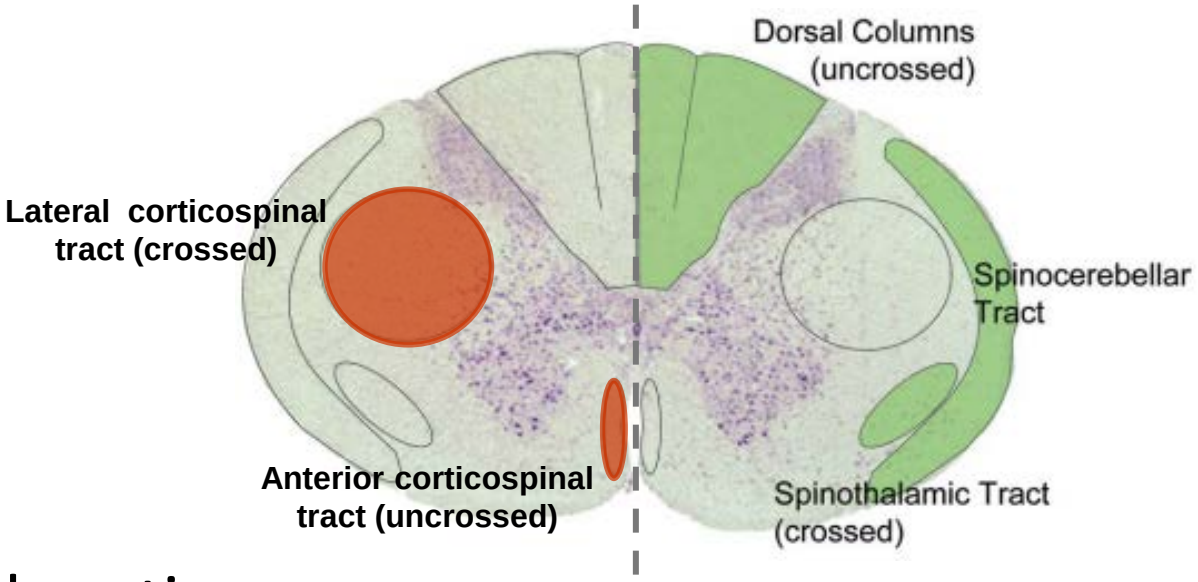


Medulla: caudal & rostral



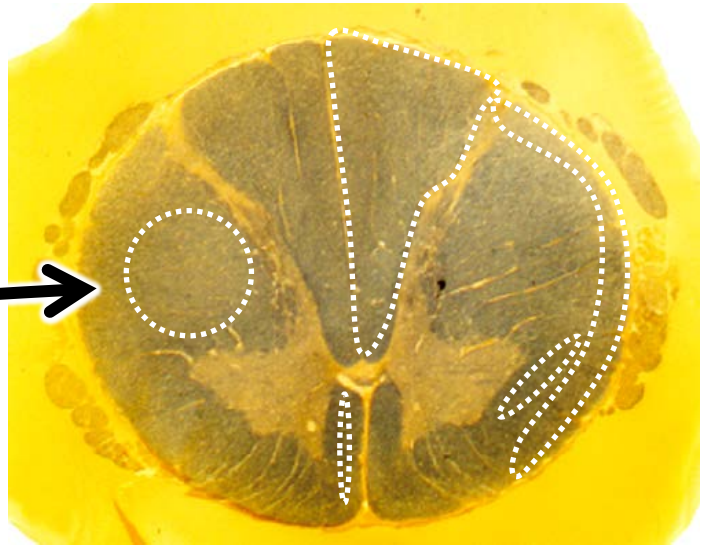
Spinal cord review



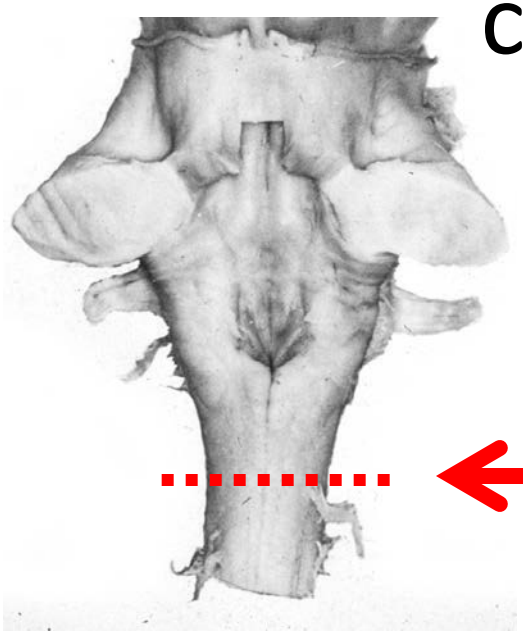


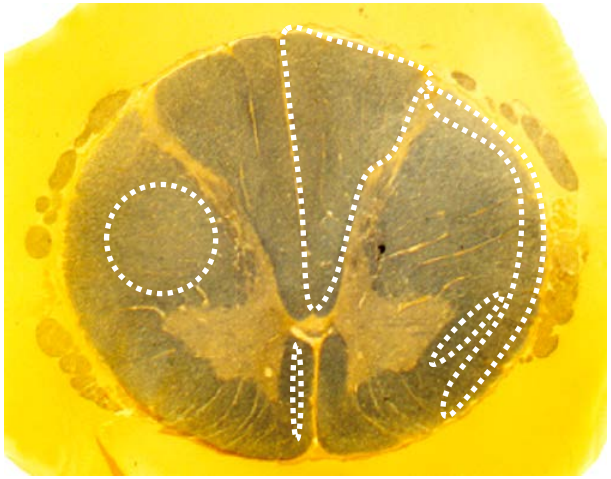
Today: myelin-stained sections

Myelin (axon tracts) is DARK

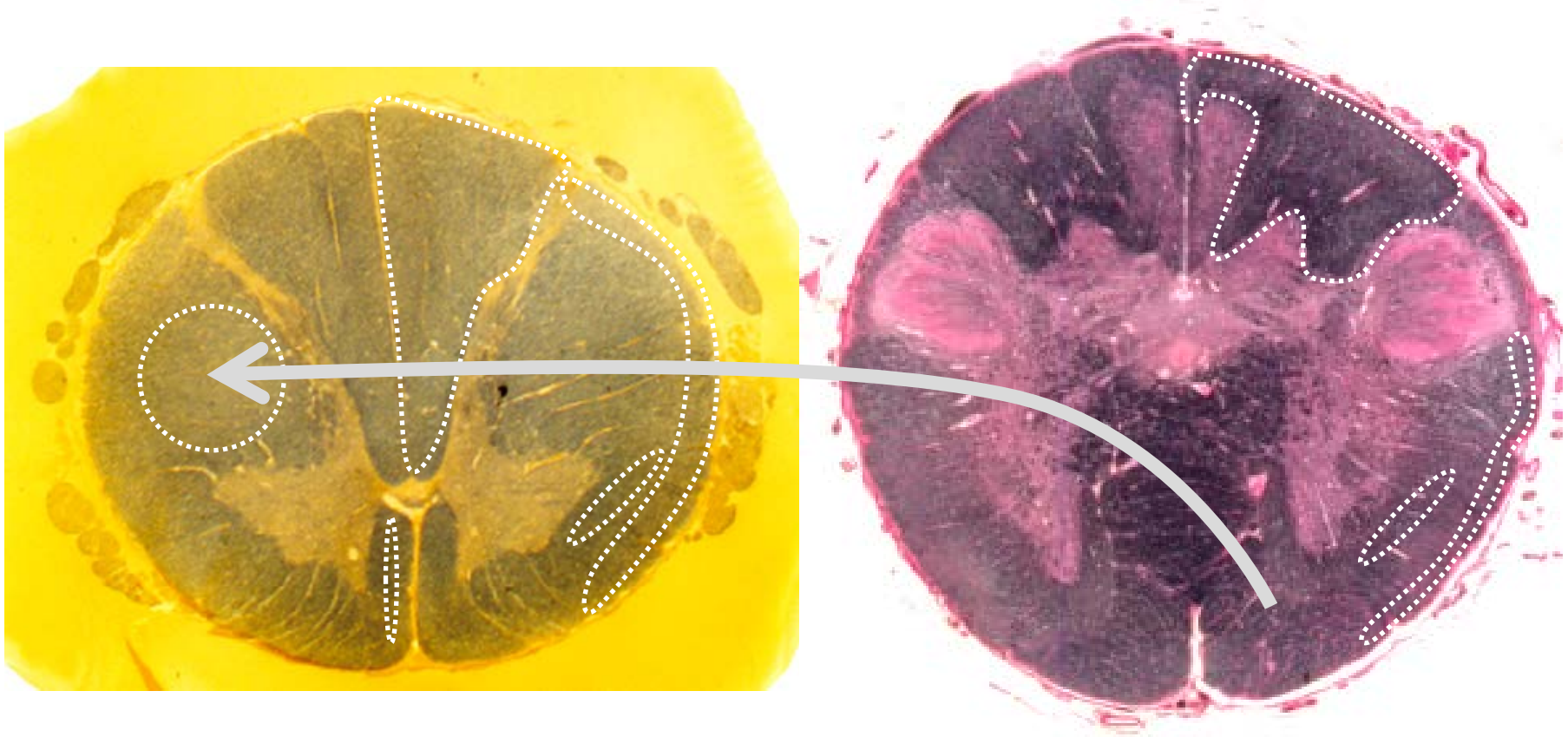


Caudal medulla: what has changed compared to spinal cord?





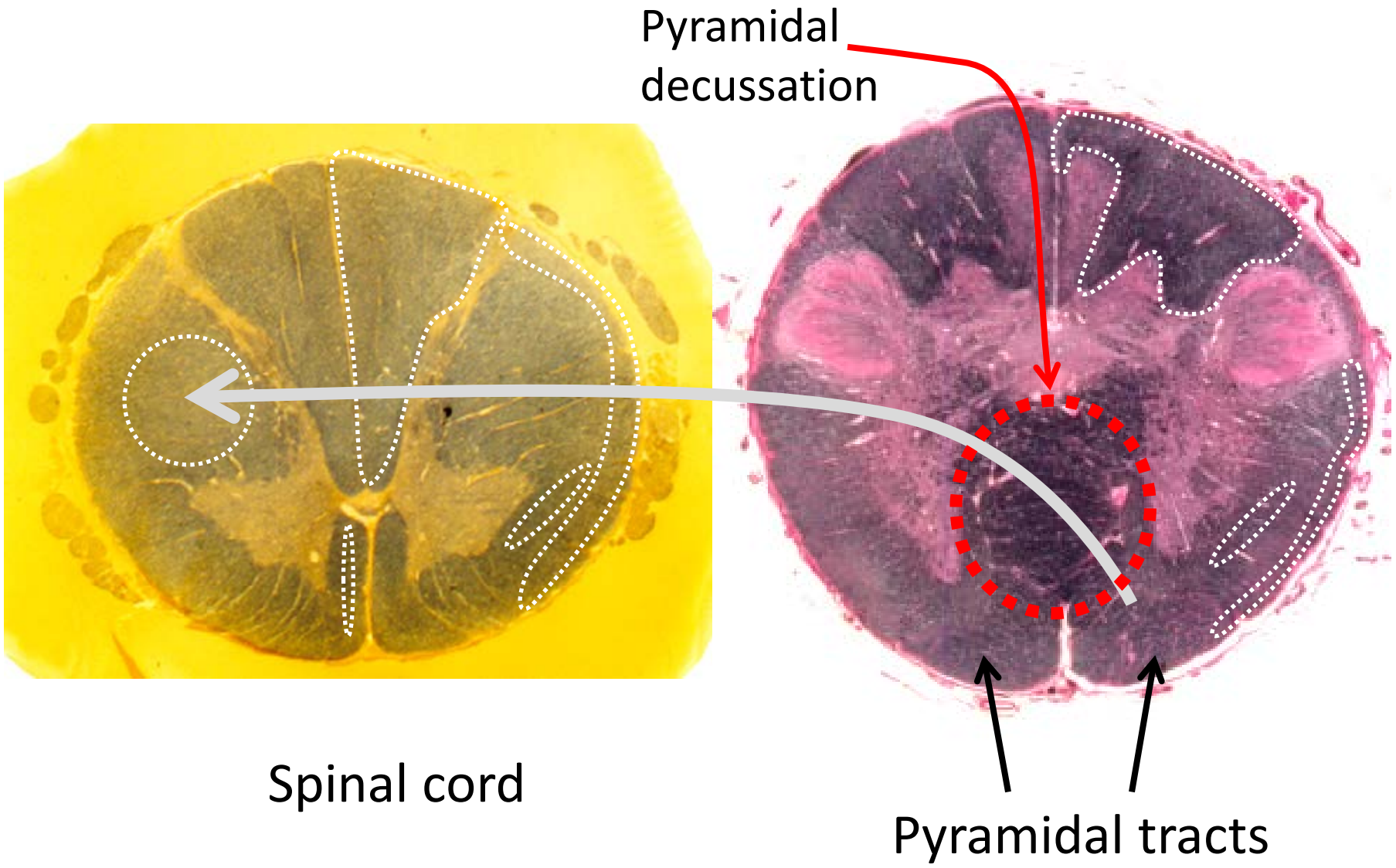
“Pyramidal decussation”: crossing of corticospinal tract



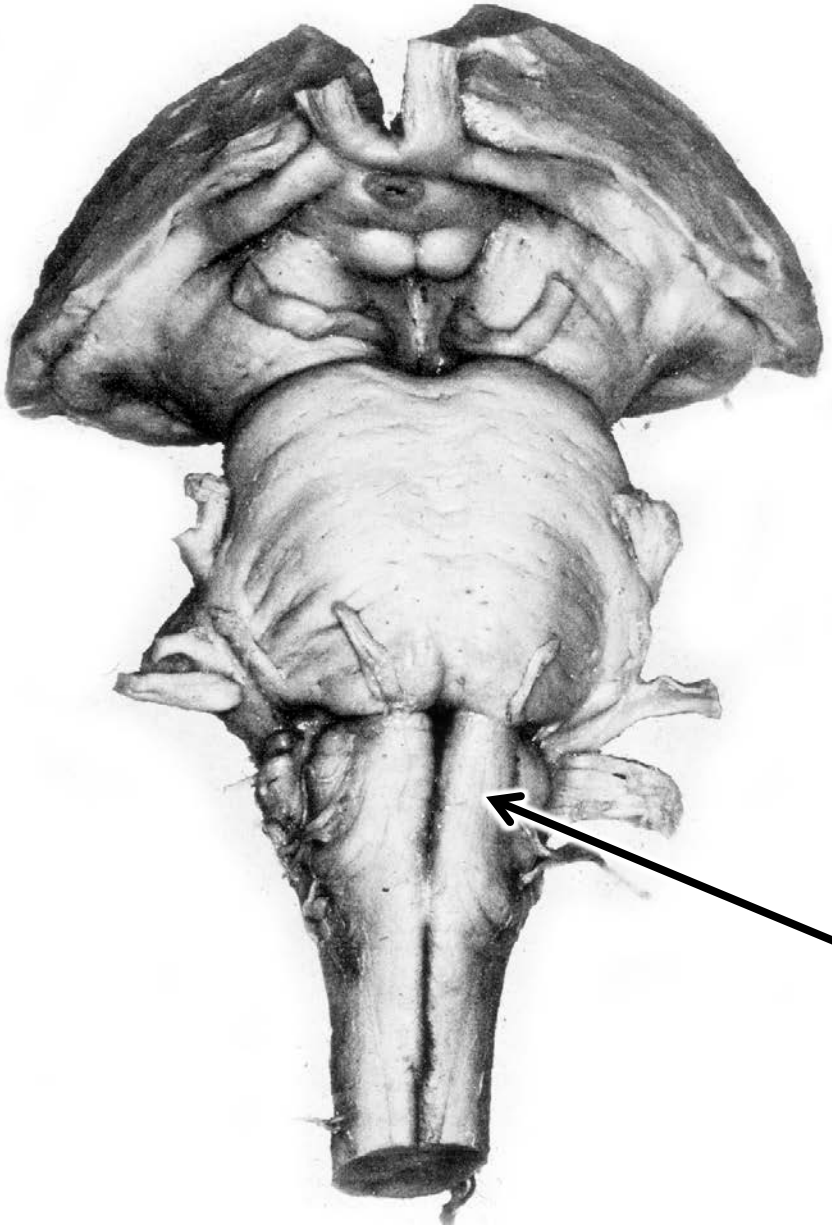
Spinal cord

Medulla

“Pyramidal decussation” (motor system)

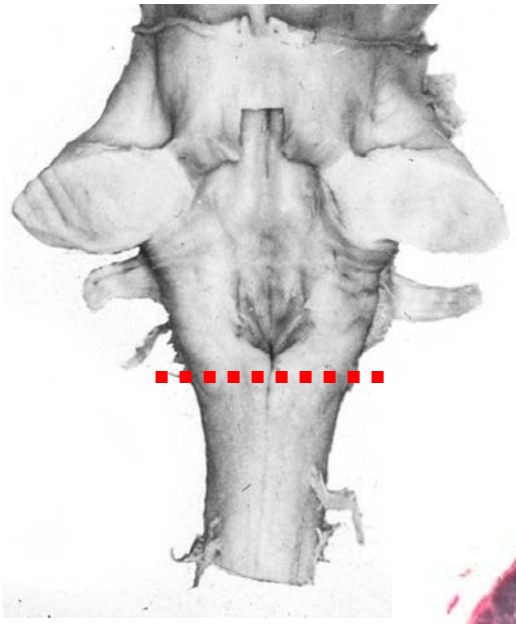


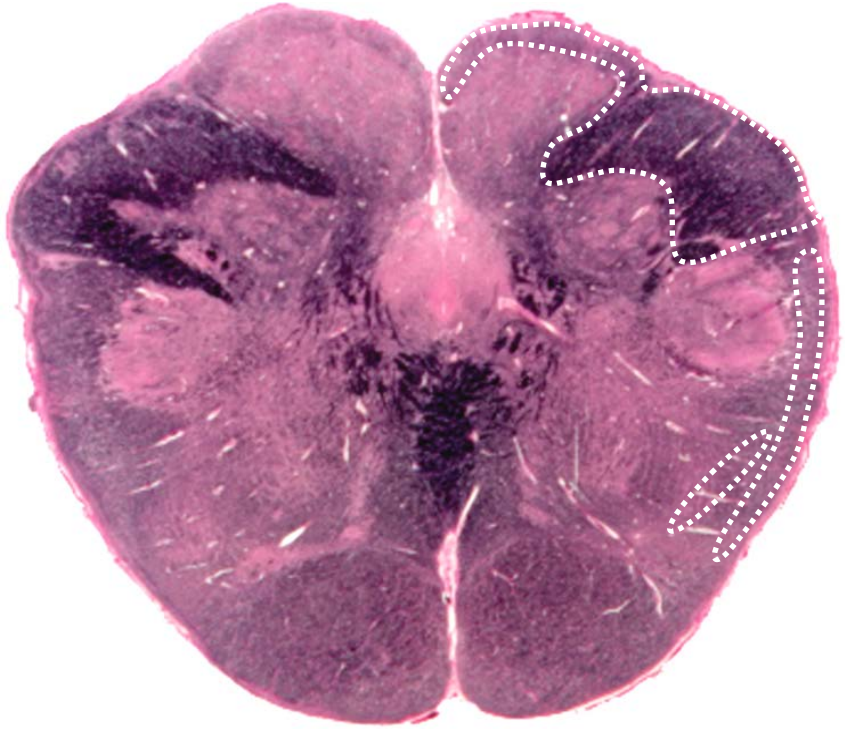
“Pyramidal tracts” (motor system)



Pyramids/
Pyramidal tracts

Border of caudal & rostral medulla

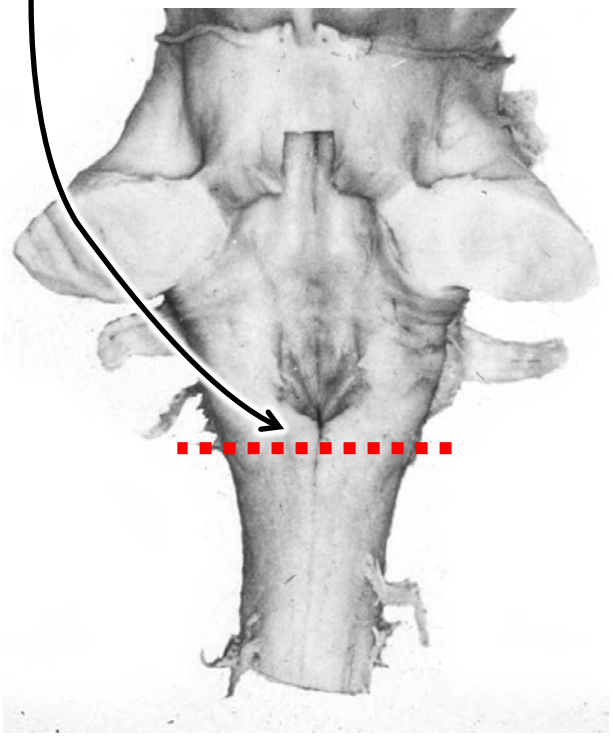


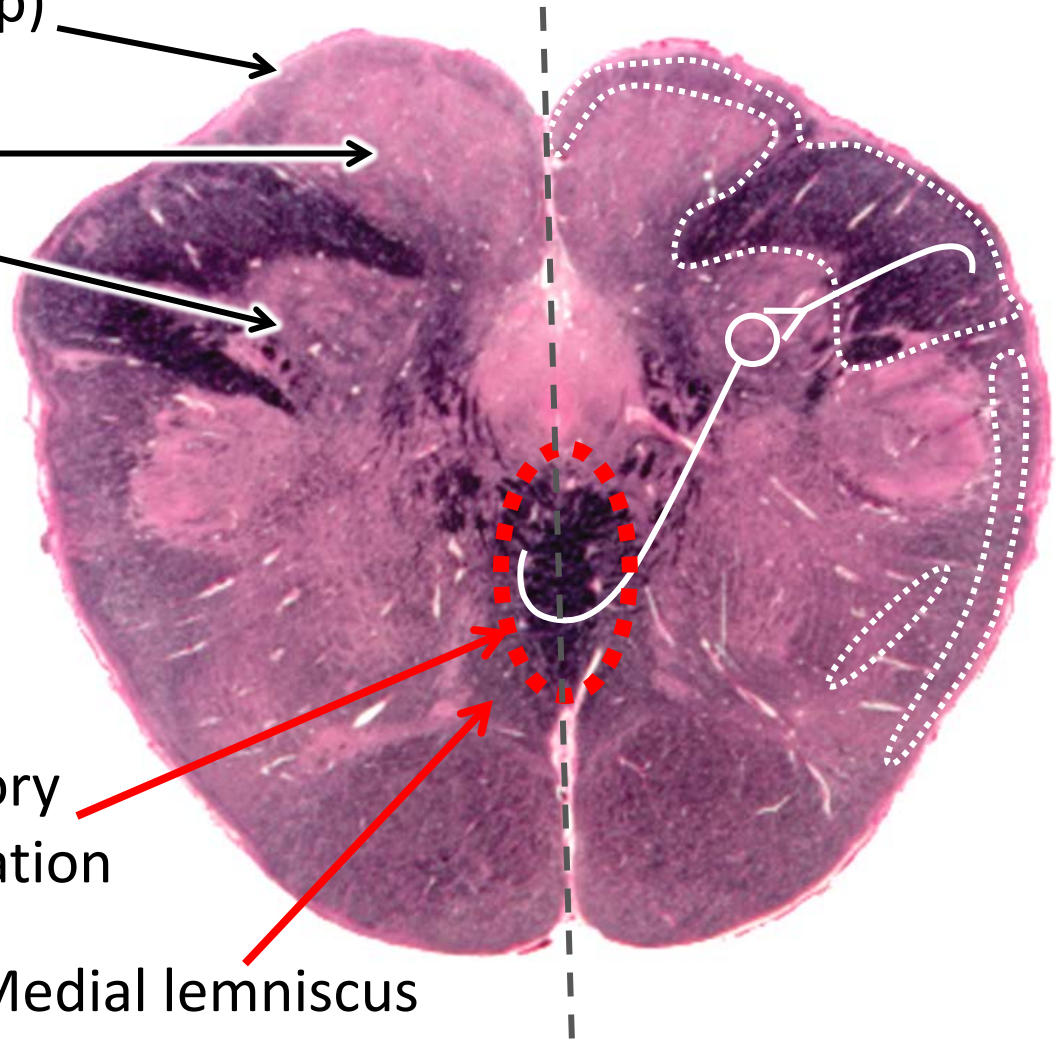


Caudal medulla

Pyramidal tracts

Border of caudal & rostral medulla: sensory decussation





Gracile tubercule (bump)

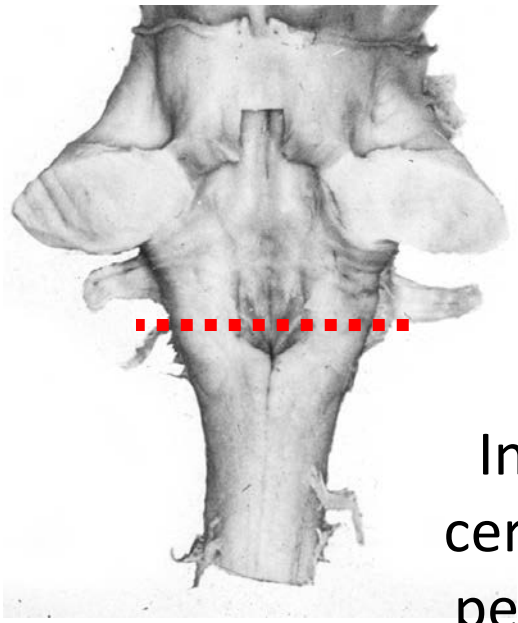
nucleus gracilis

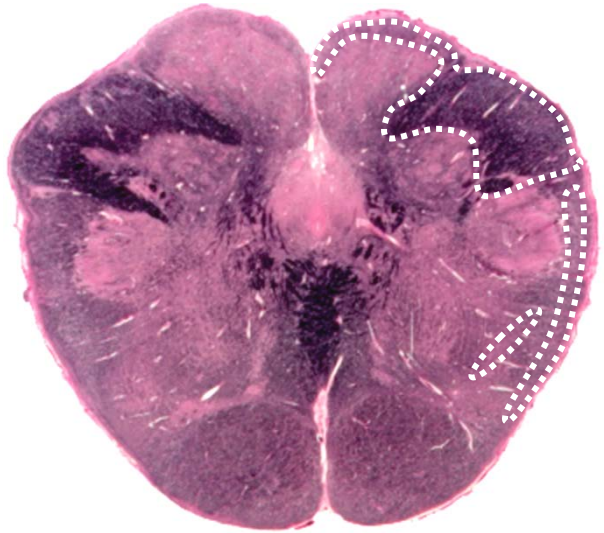
nucleus cuneatus

Sensory decussation

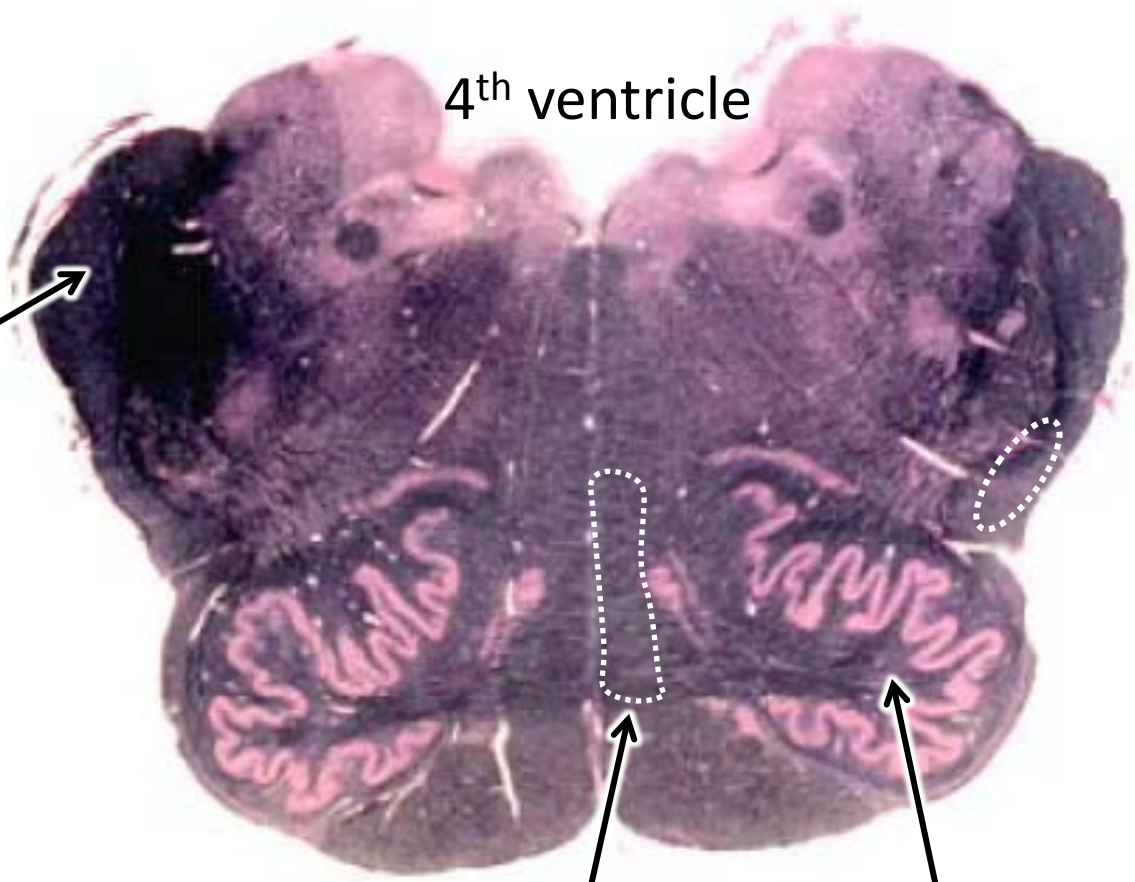
Medial lemniscus

Rostral medulla

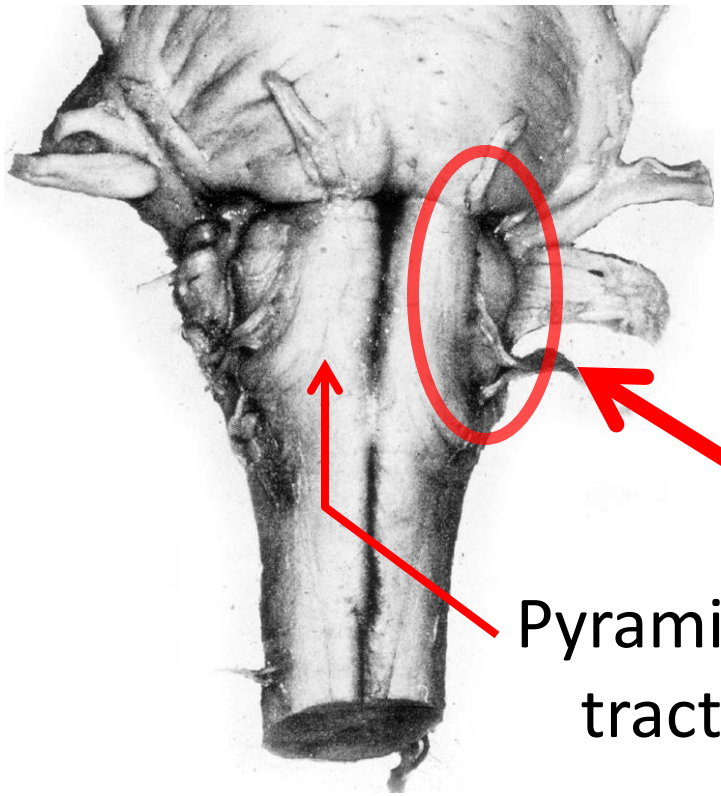




Border of caudal & rostral medulla

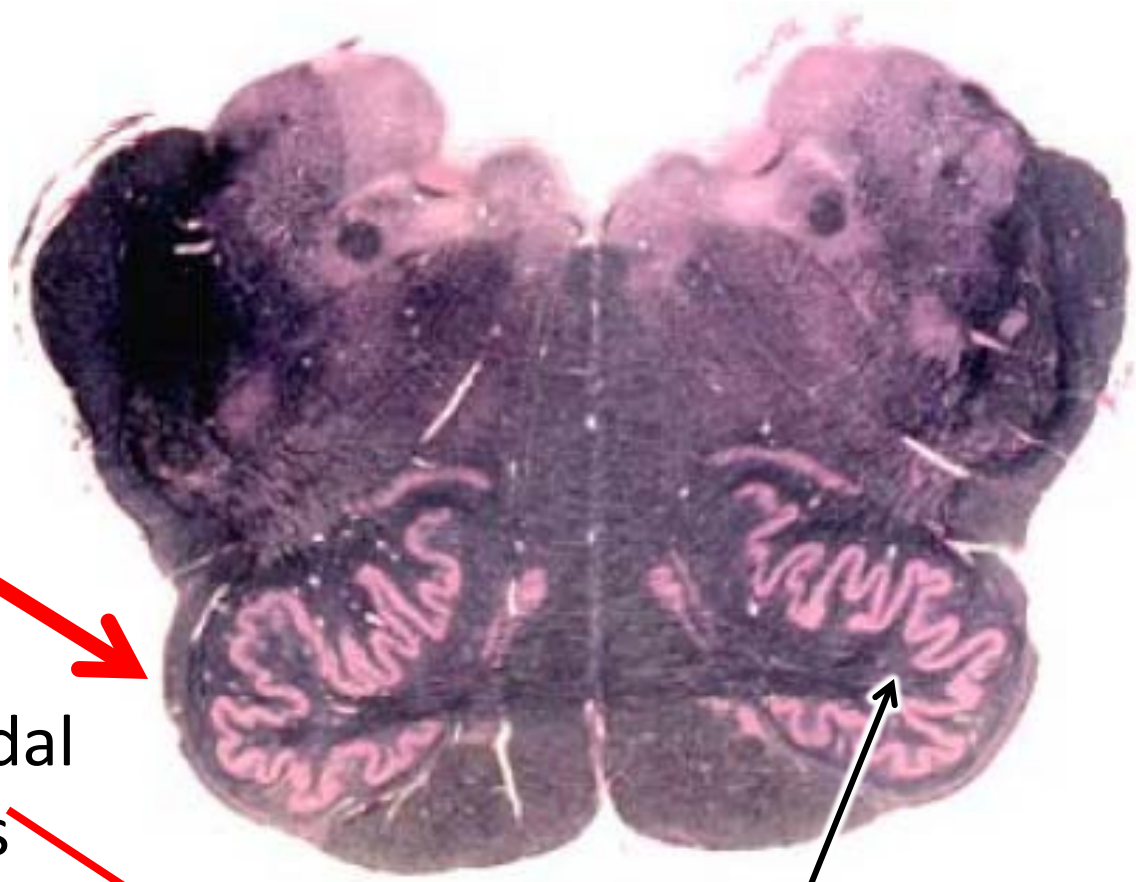


Gross structures of rostral medulla



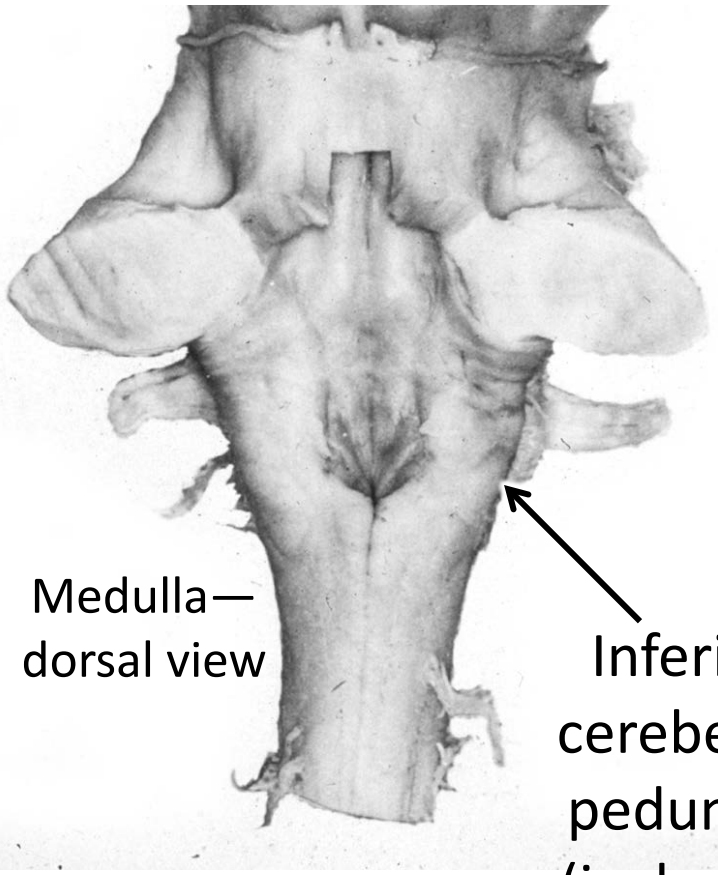
Medulla—
ventral view

Pyramidal
tracts



Inferior olive

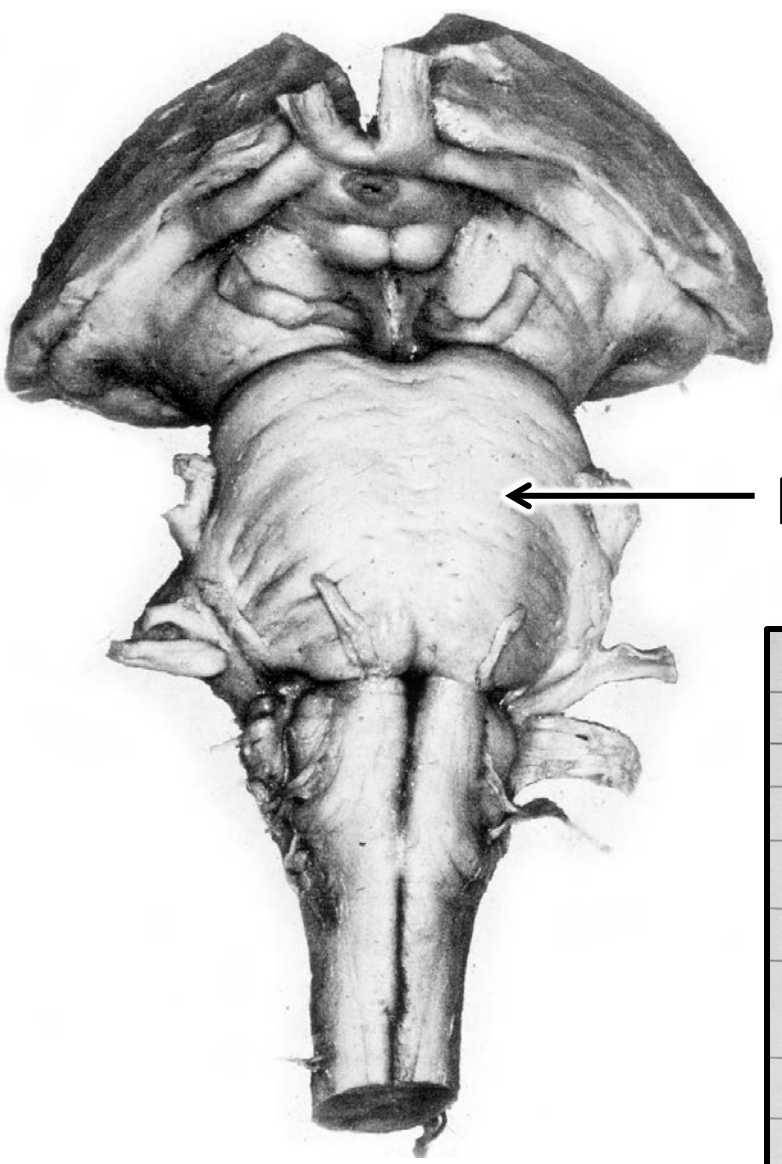
Gross structures of rostral medulla

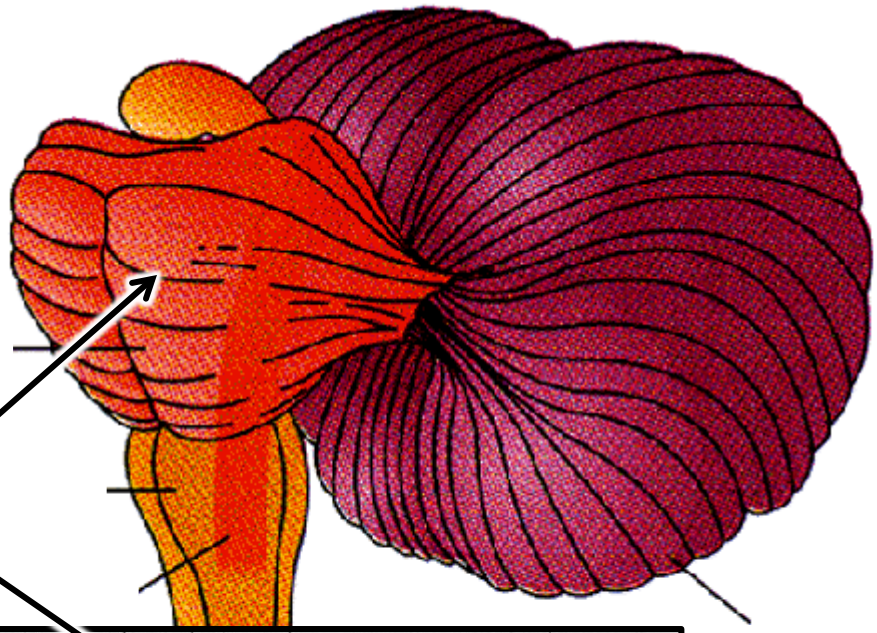


Medulla—
dorsal view

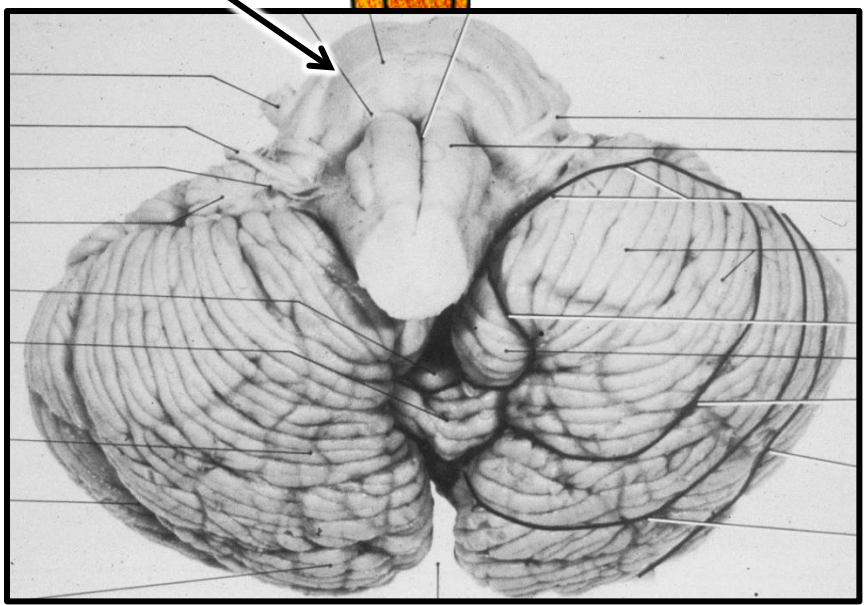
Inferior cerebellar peduncle (including spinocerebellar tract)

Pons (Latin, “bridge”)

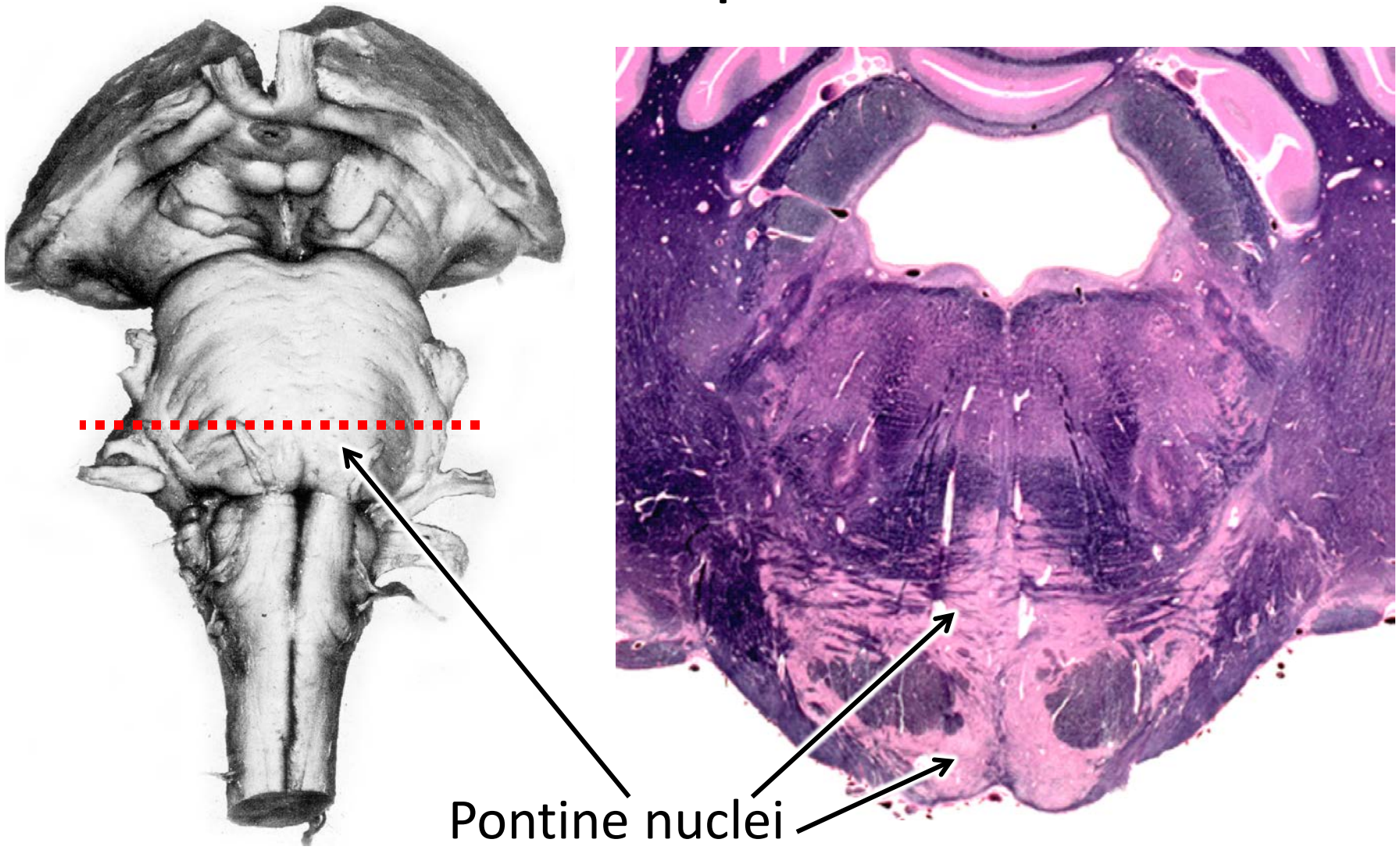




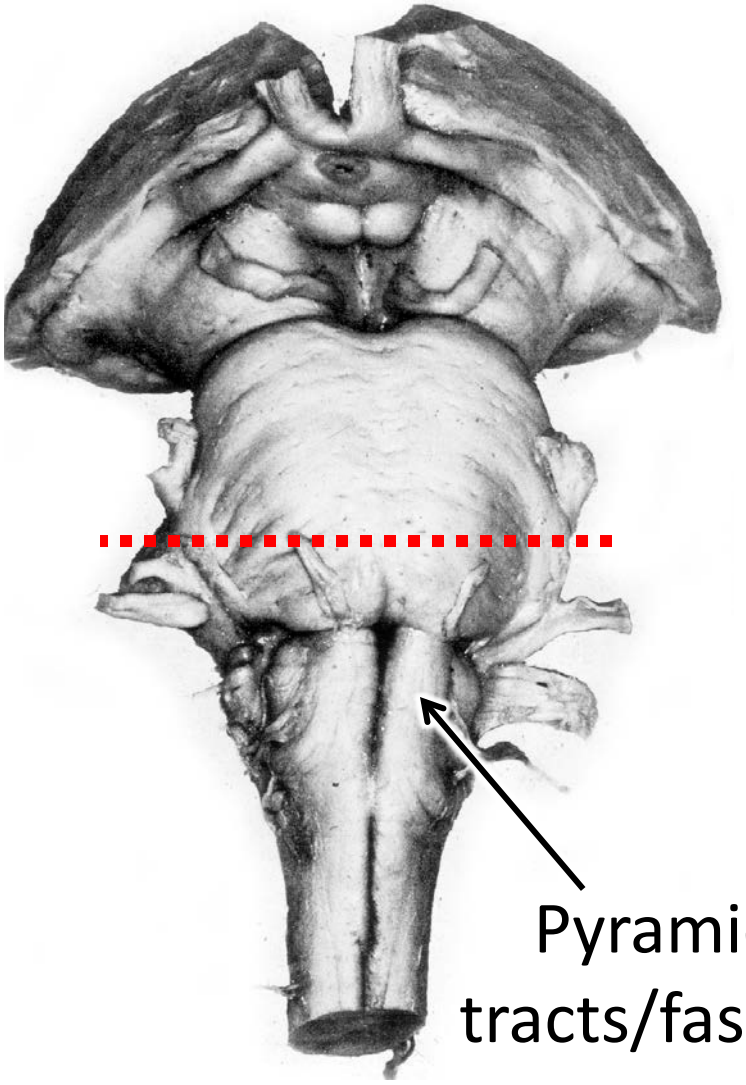
Pons

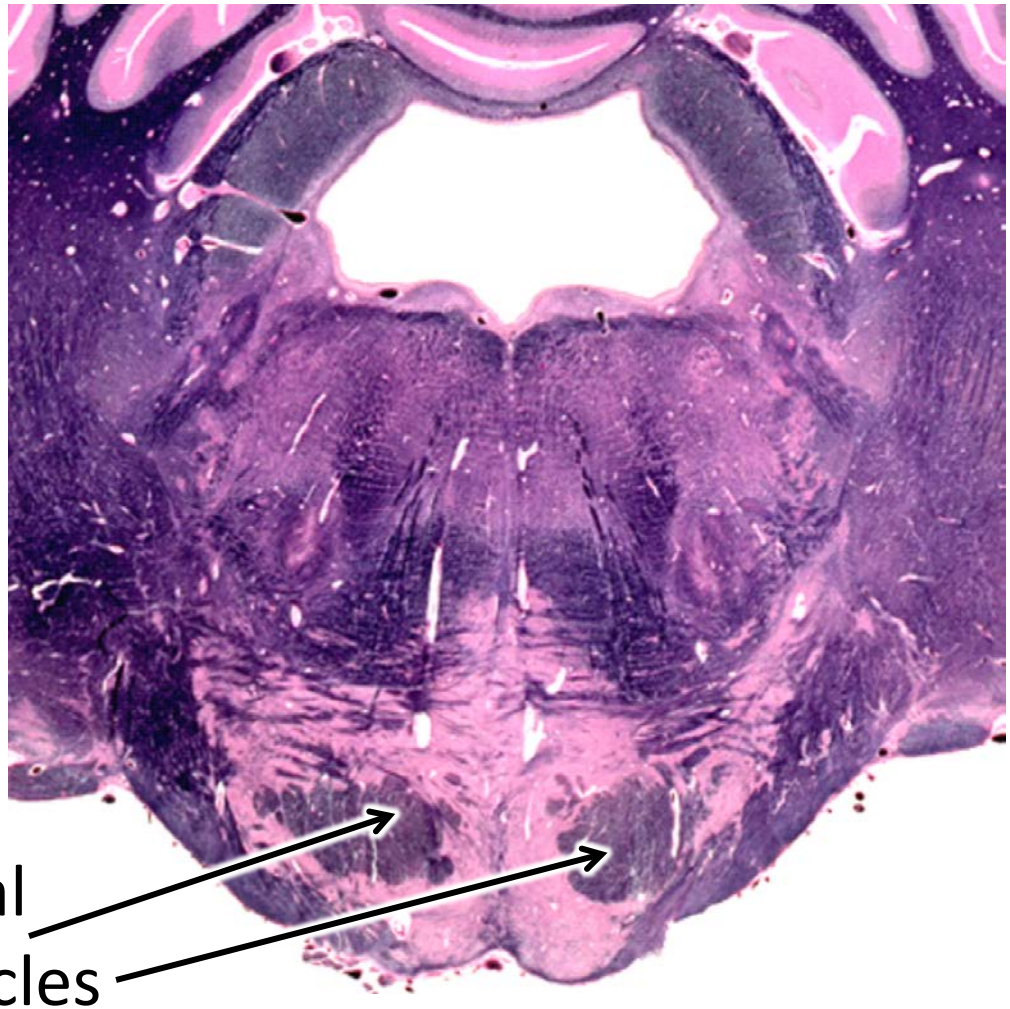


Pontine nuclei make the big bulge of the pons



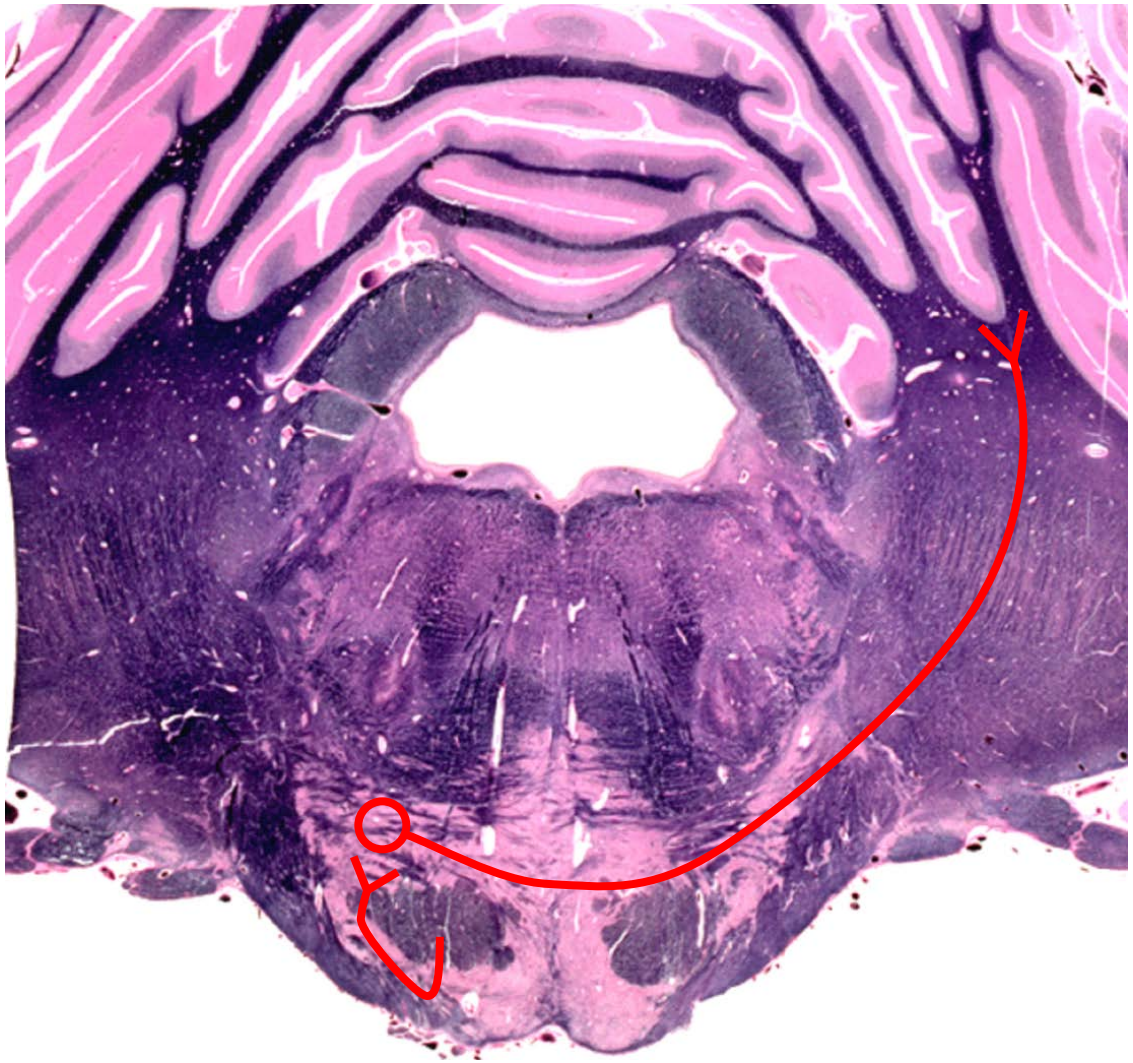
Where did the pyramids go?



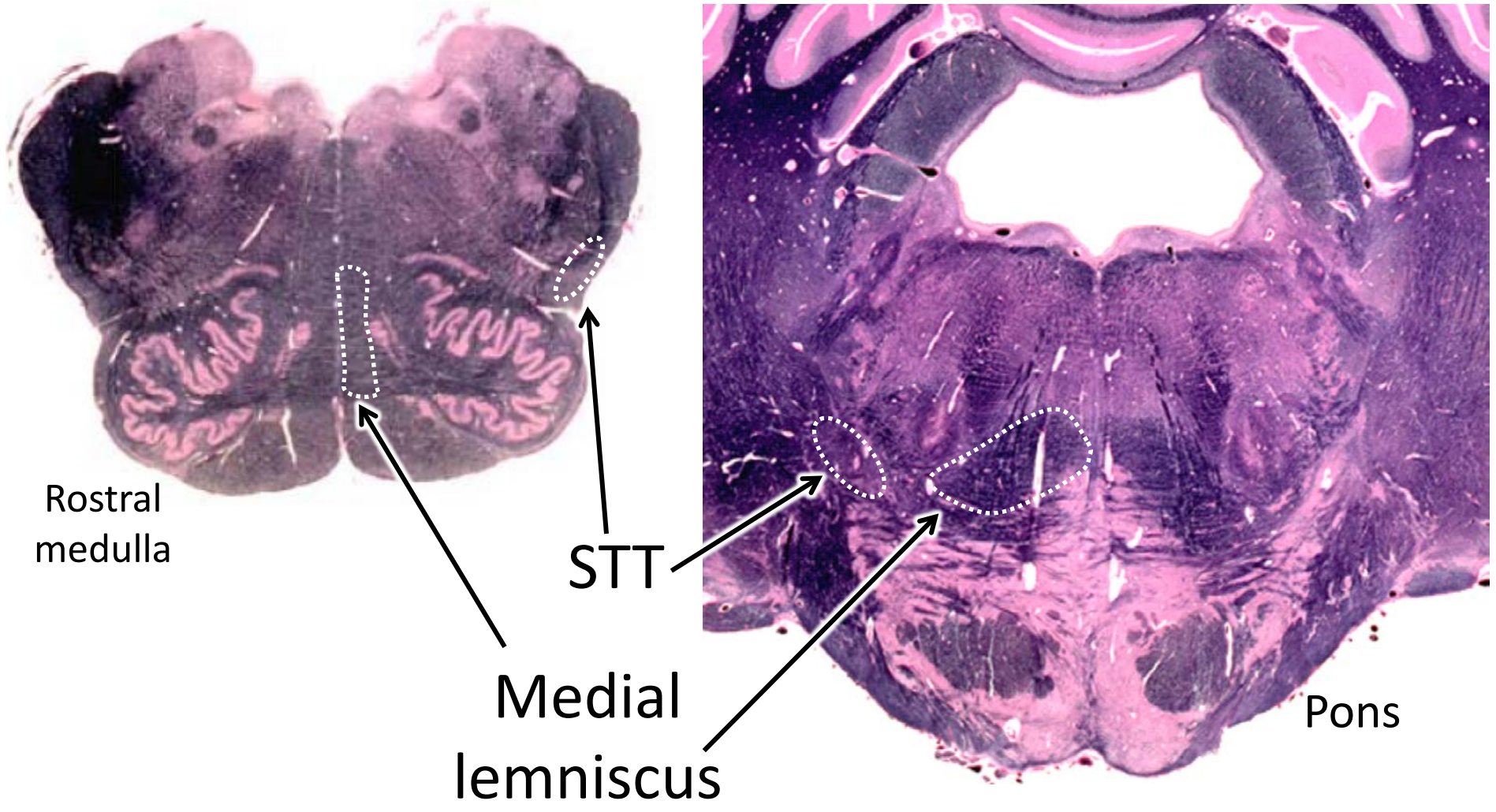


Pyramidal tracts/fascicles

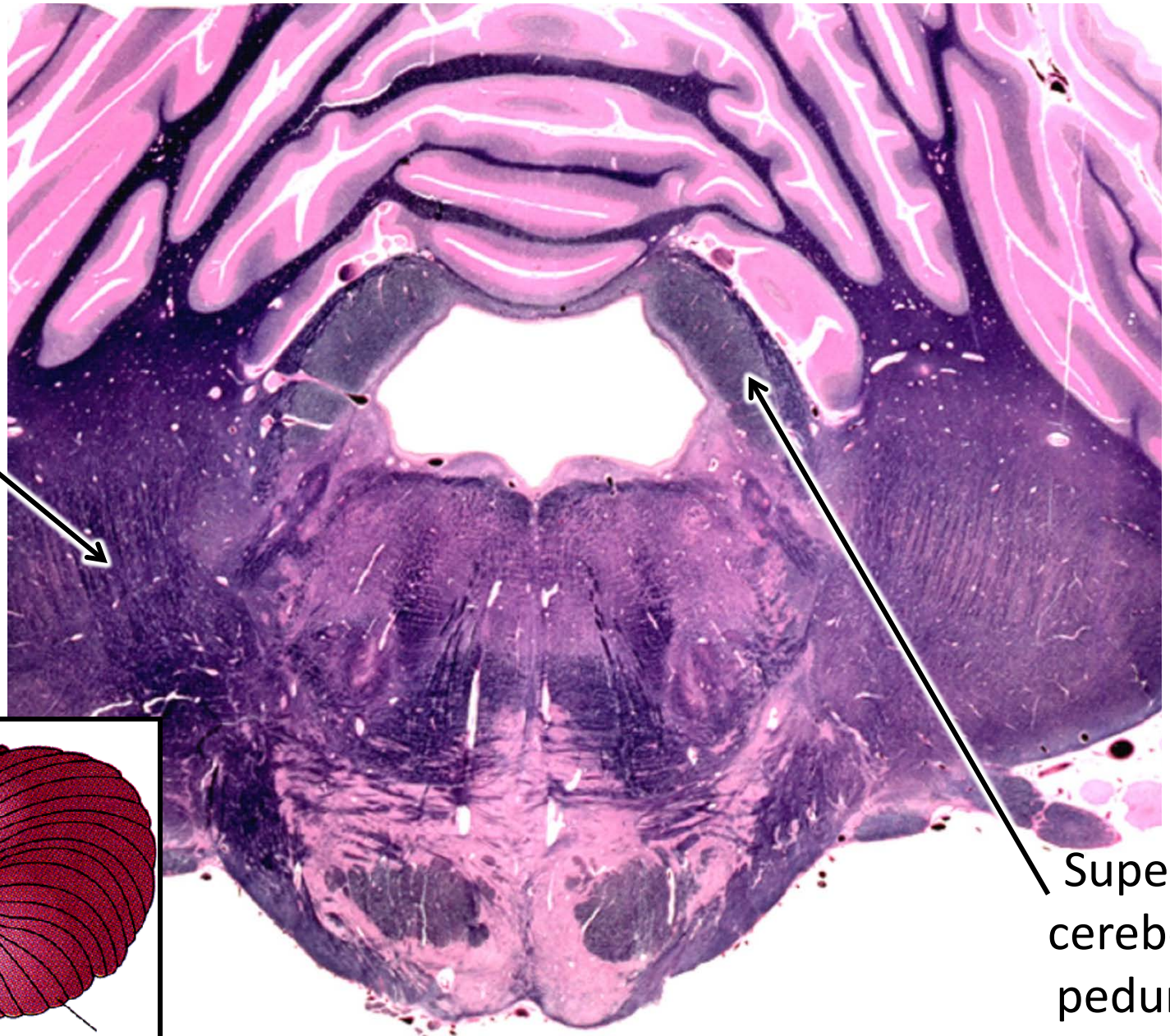
Pyramidal fascicles: corticospinal fibers *plus* corticopontine fibers innervating pontine nuclei

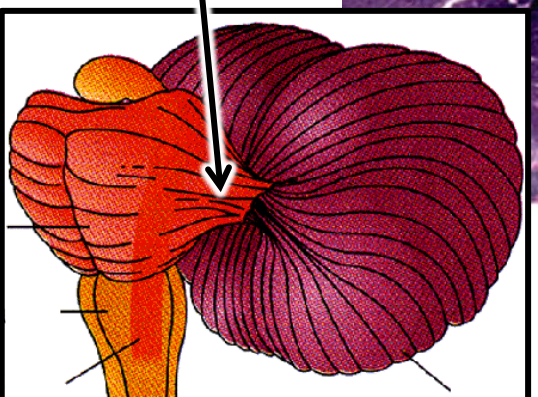


What happened to the medial lemniscus & spinothalamic tract (STT)?

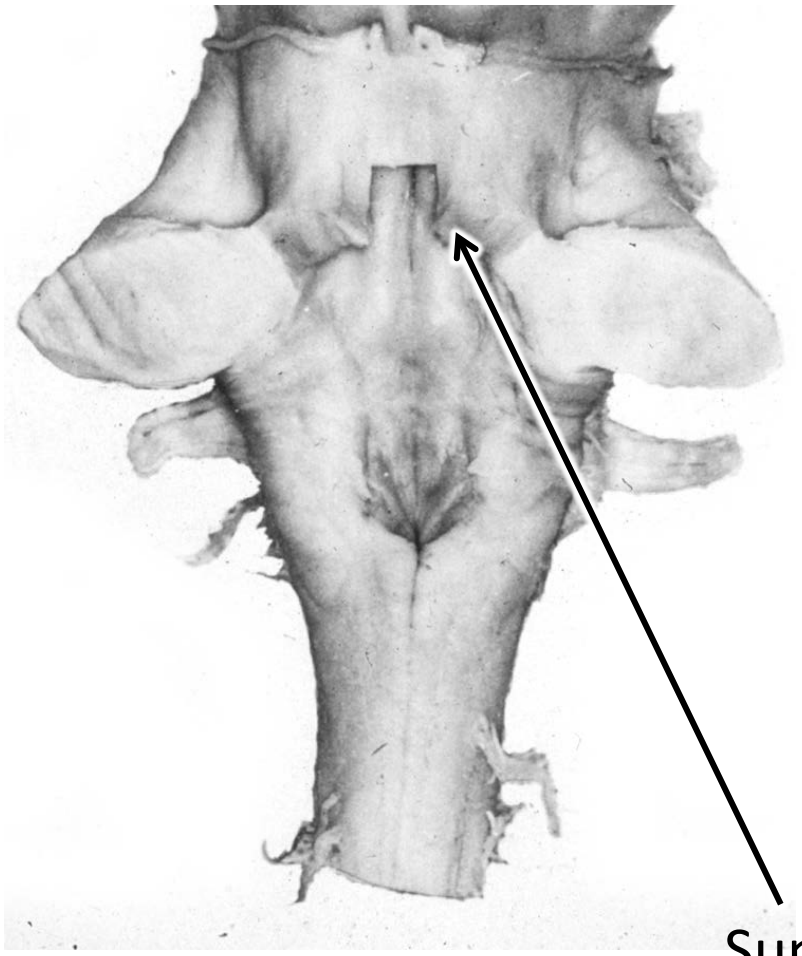


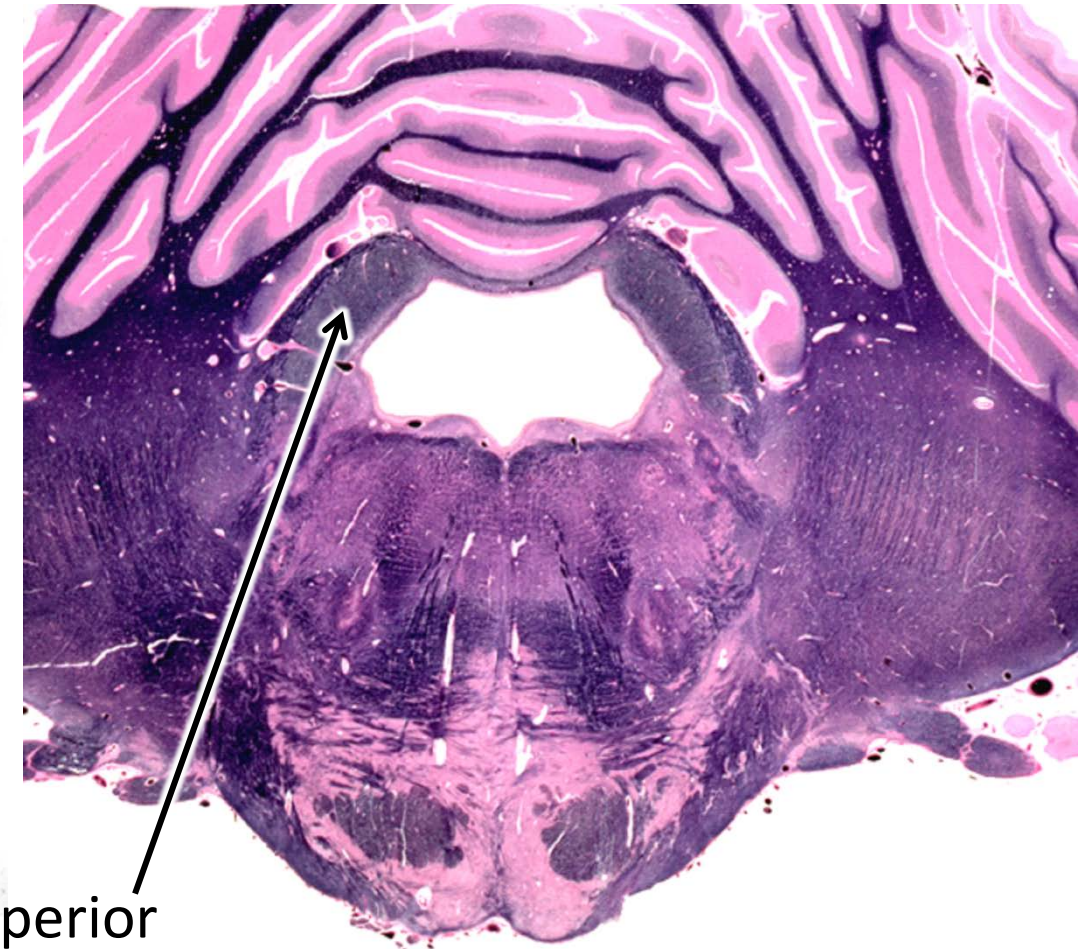
New structures at the level of the pons





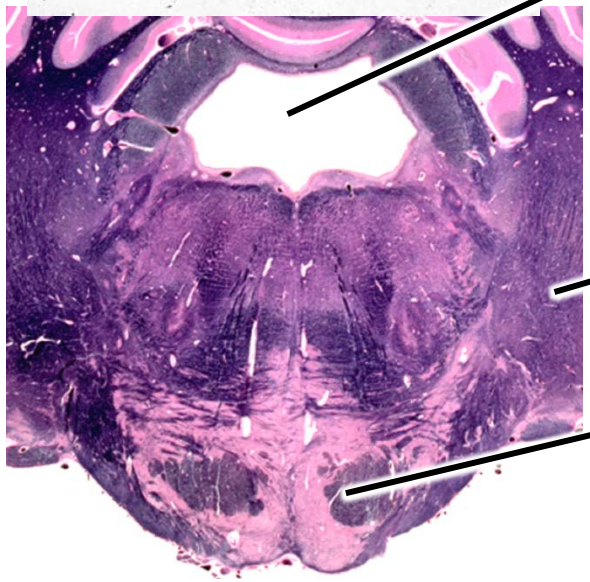
Superior cerebellar peduncle



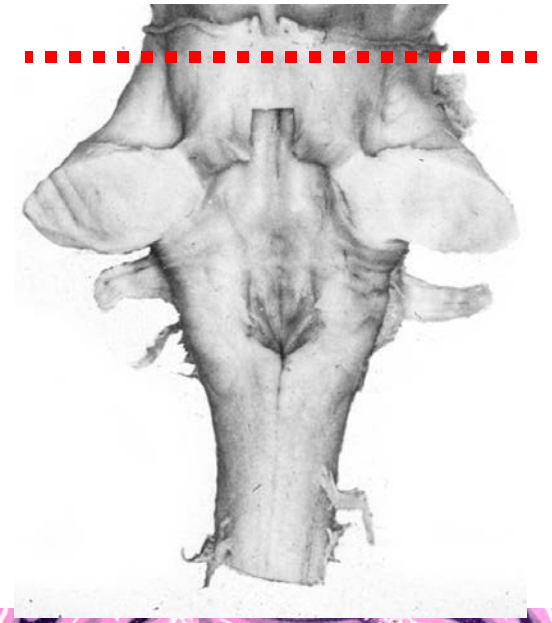


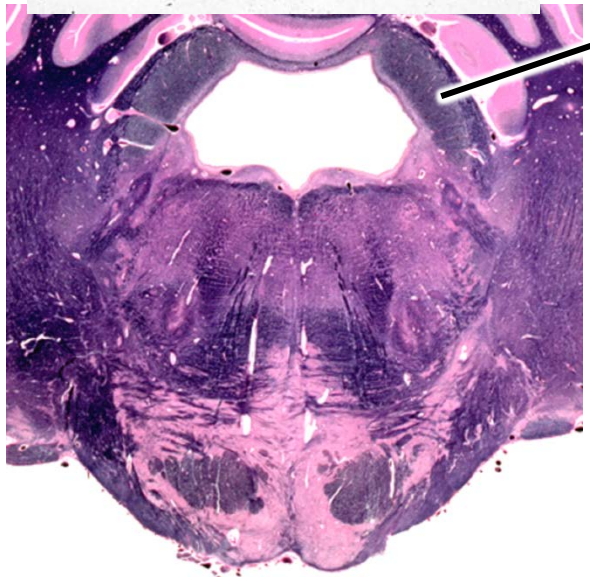
Superior cerebellar peduncle

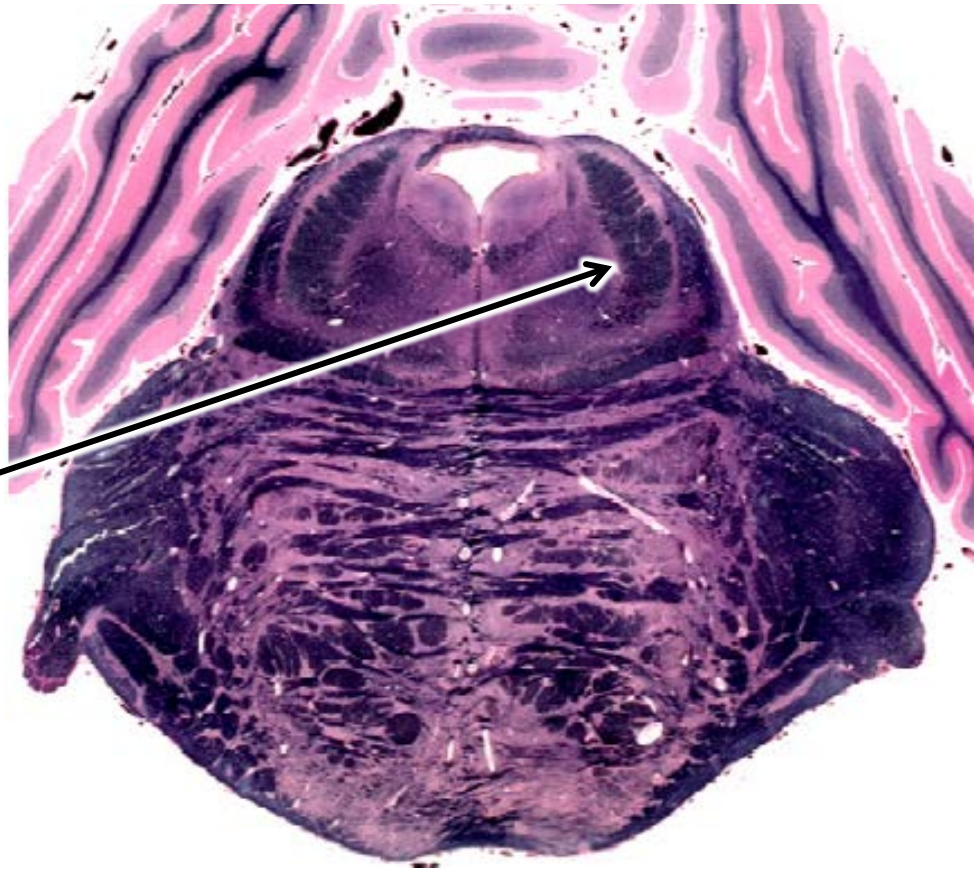
Rostral pons: what's changed?



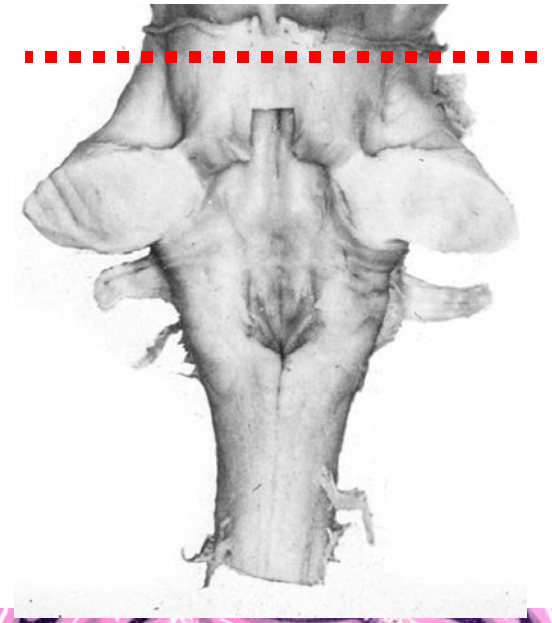
Superior cerebellar peduncle

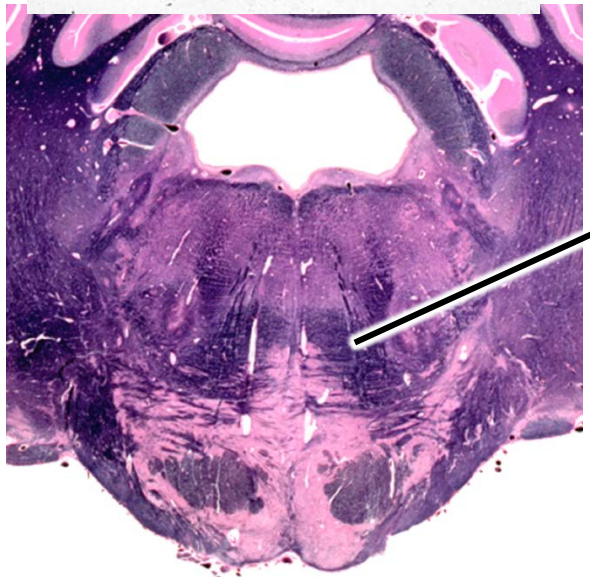


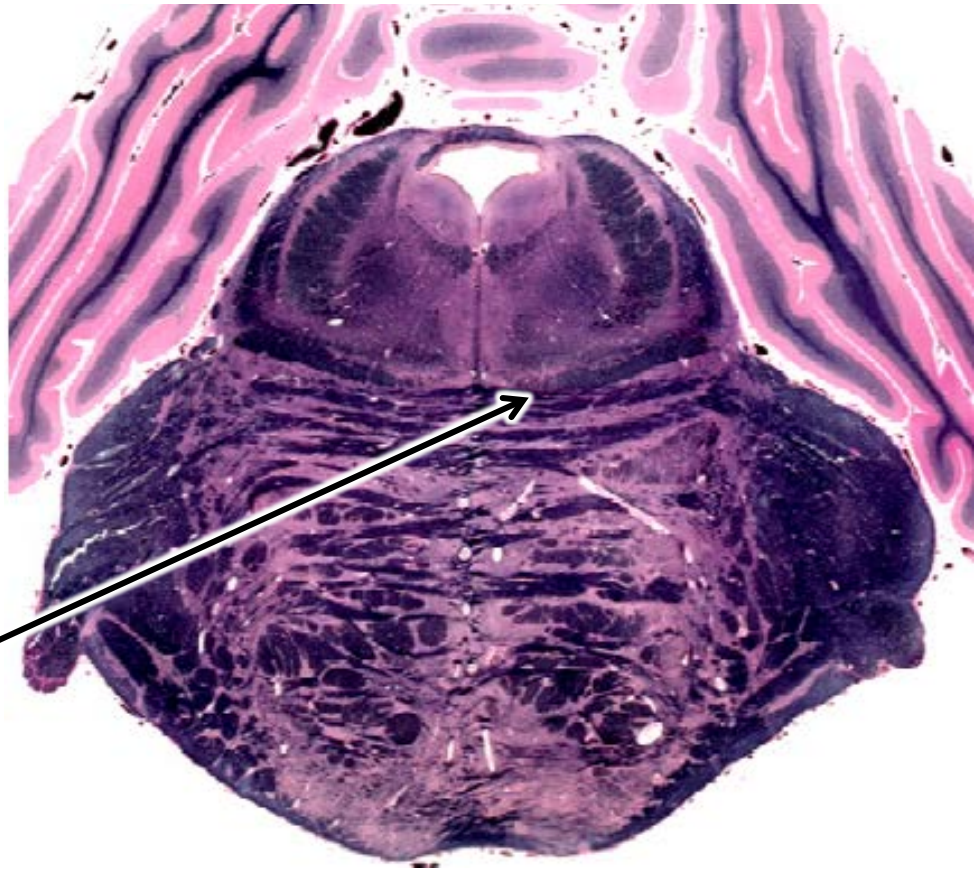




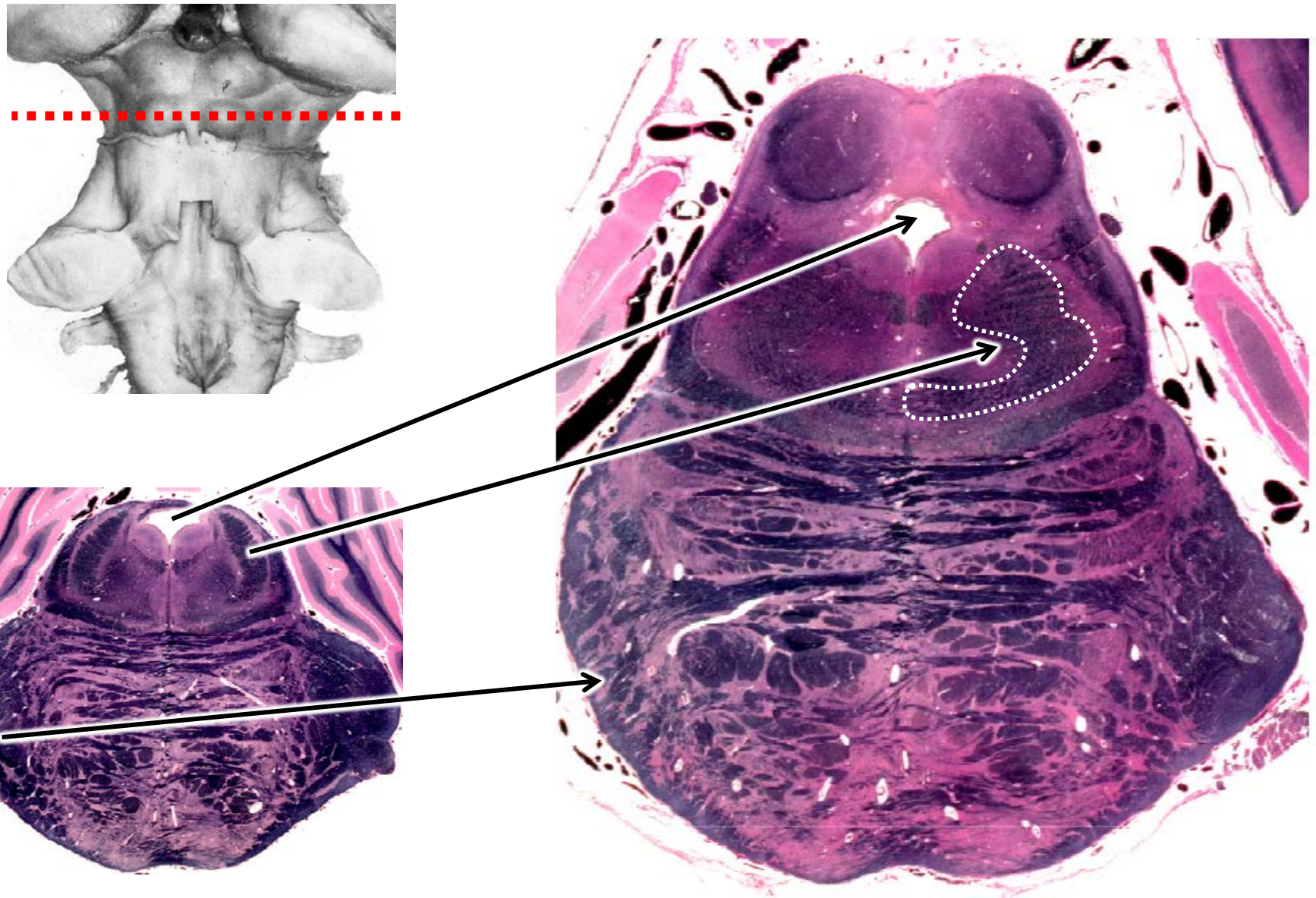
Medial lemniscus



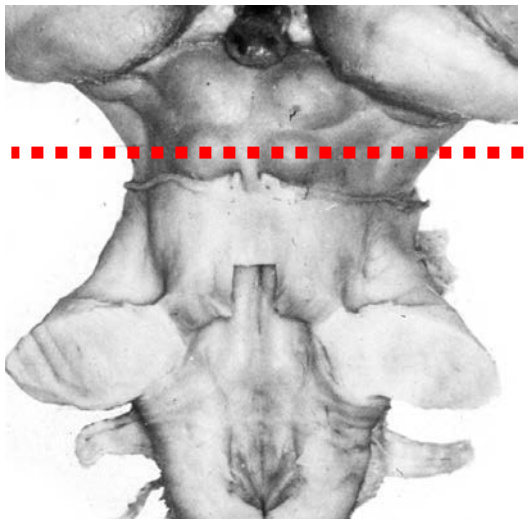




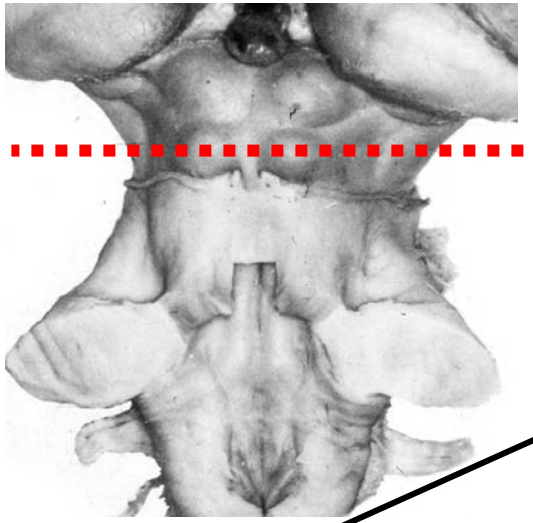
Caudal midbrain: What's changed?



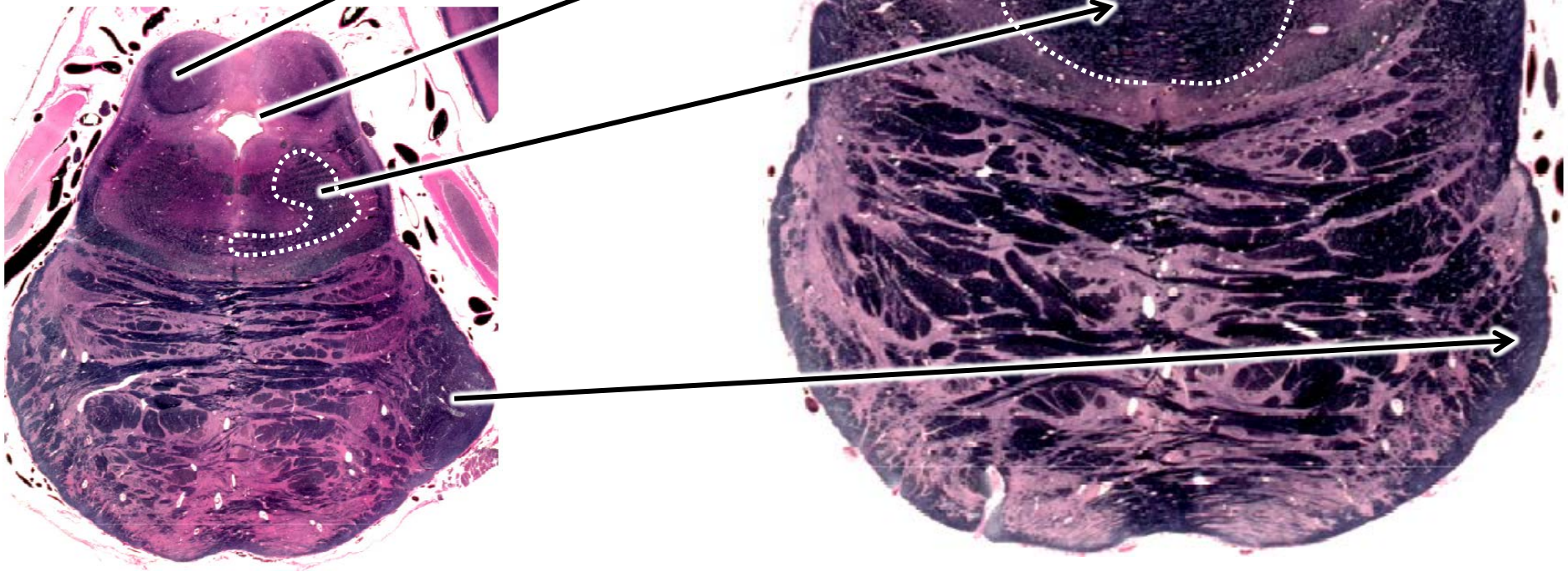
Caudal midbrain: medial lemniscus



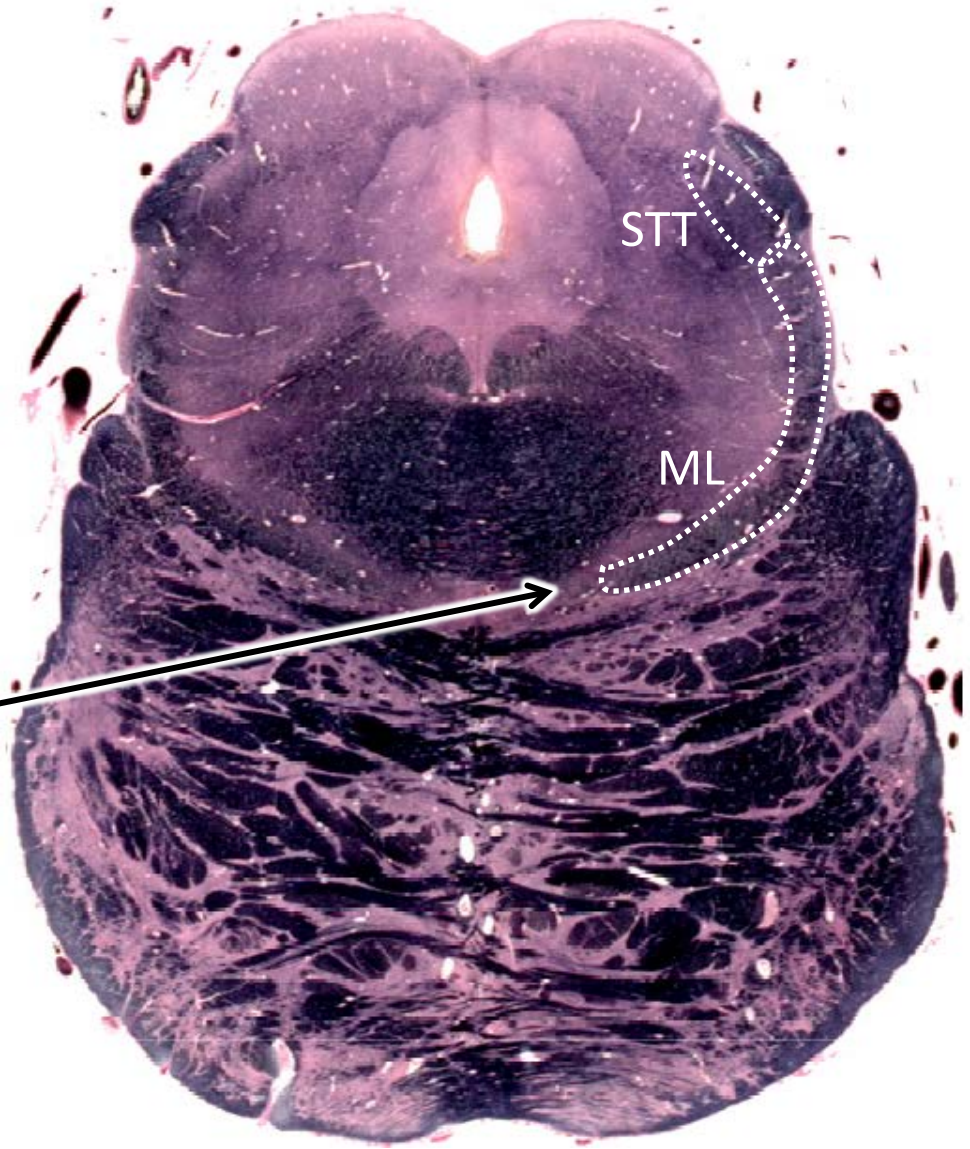
Caudal midbrain: What's new?



Middle mid-brain: what's changed?

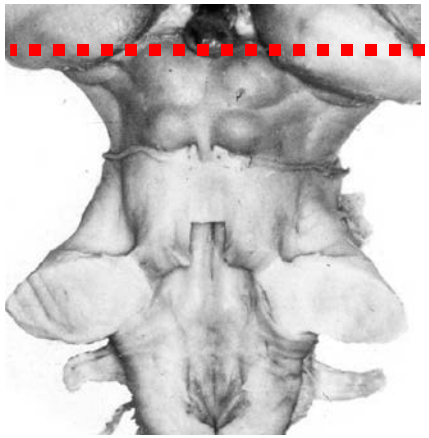


Medial lemniscus

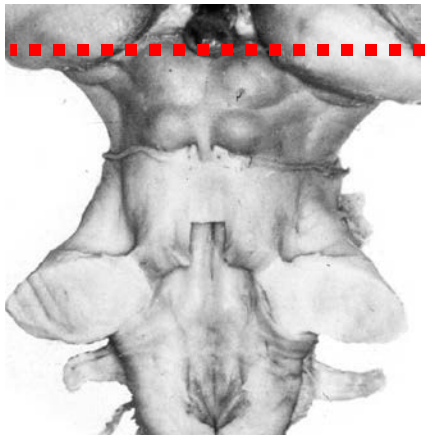


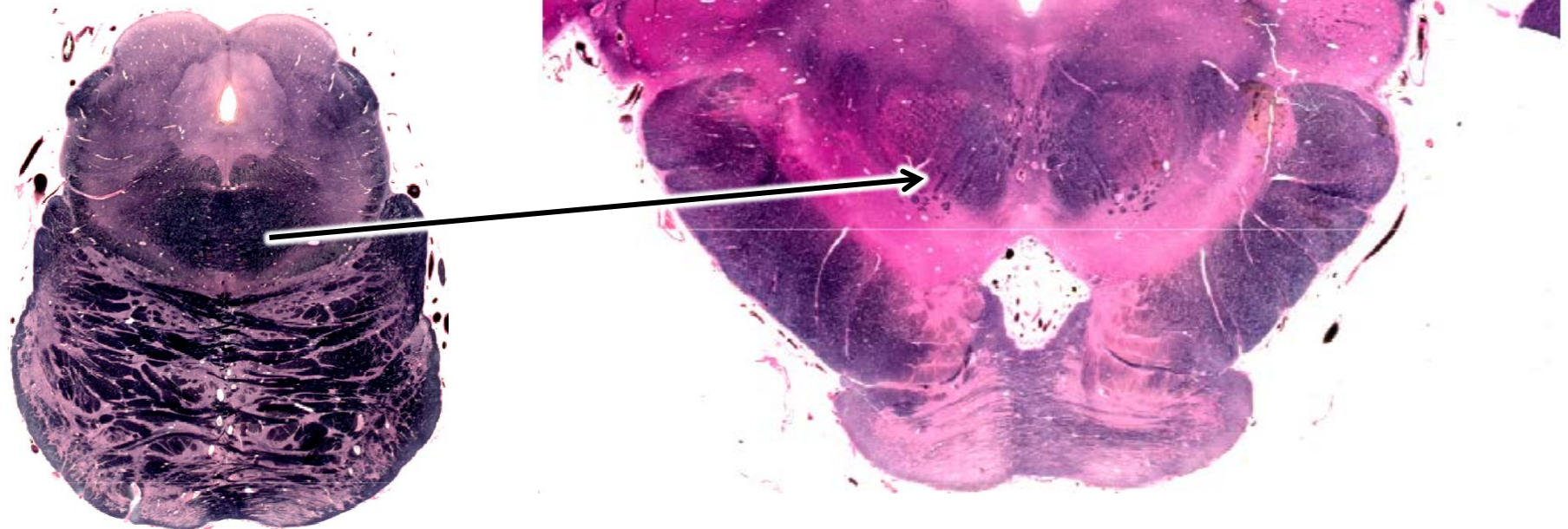
Middle mid-brain: what's new?

Rostral midbrain: what's changed?



Superior cerebellar peduncle





Rostral midbrain: what's new?

Pinky & the Brain

- https://www.youtube.com/watch?v=snO68aJTOpM