

# **Nervous system: brain, spinal cord**

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**2021**

# Nervous system

Central nervous system



Spinal cord

brain

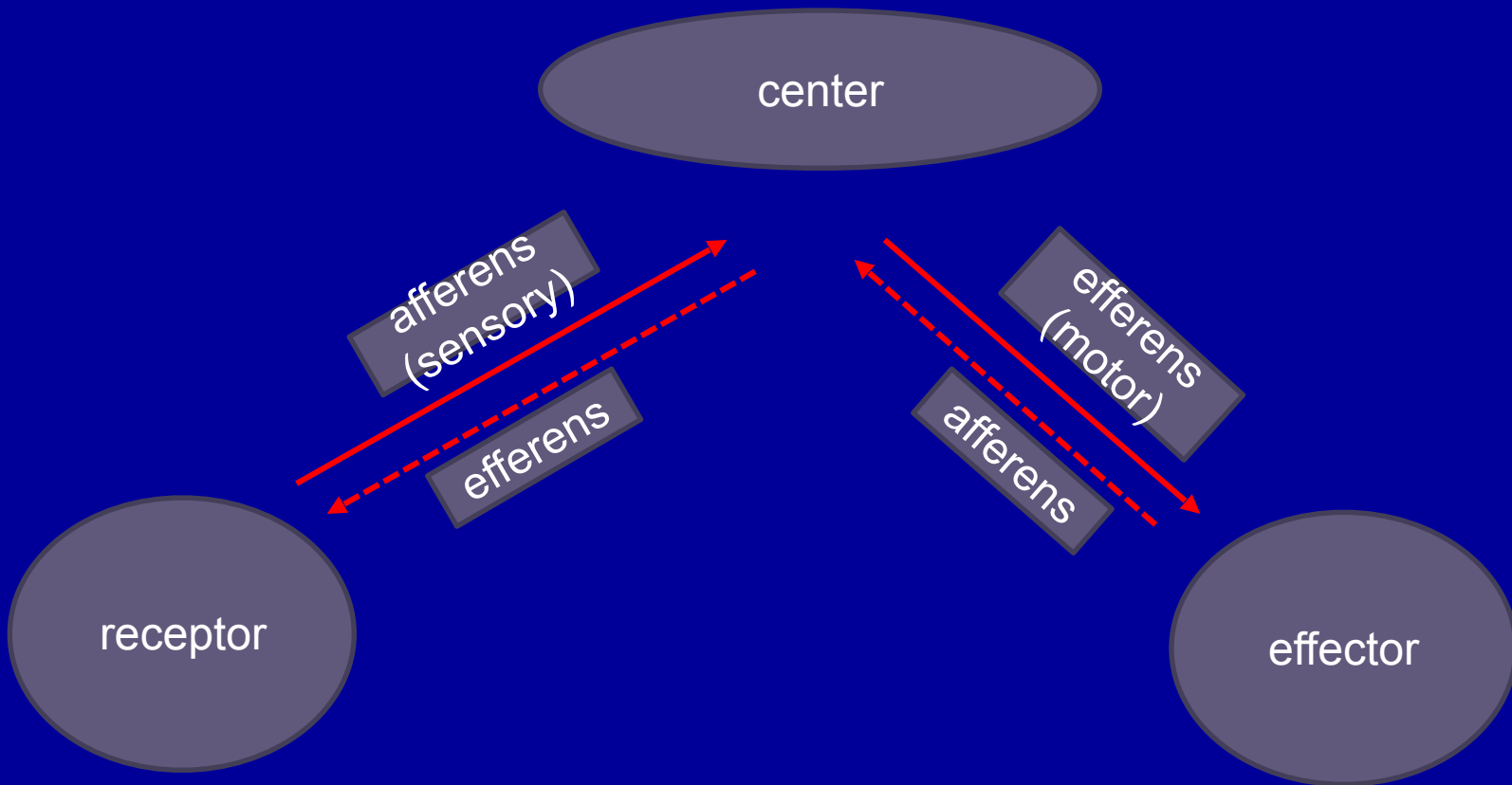
Peripheral nervous system



Spinal nerves, cranial nerves,  
ganglions

Functionally: somatic (axial muscles)  
vegetative: (internal organs)

# Reflex arch



# Functional division of the nervous system

## *Somatic*

- voluntary
- starts and stops functions
- segmental

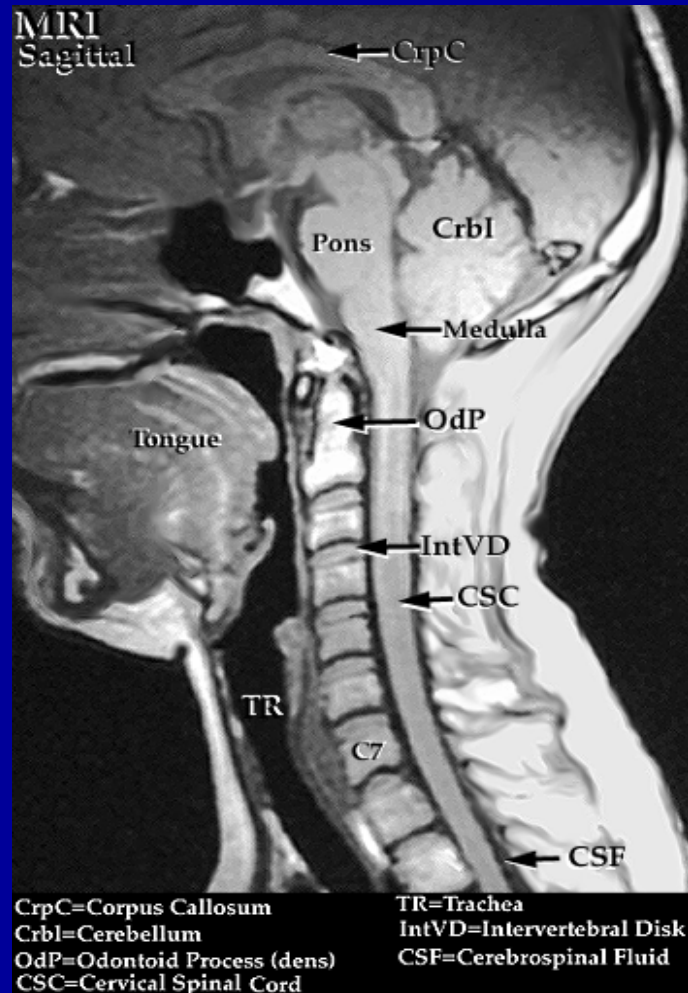
## *Autonomic (vegetative)*

- involuntary
- *regulates* the functions (slows down-speeds up)
- network

*sympathetic*  
*thora-columbar*

*parasympathetic*  
*cranio-sacral*

# Central nervous system: Spinal cord



# Spinal cord: meningeal layers

- Dura mater: outer layer: *endorachis*

inner layer

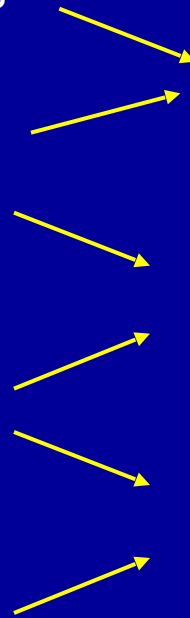
epidural spce

- Arachnoid layer

subdural spaceS

- Pia mater

subarachnoid space



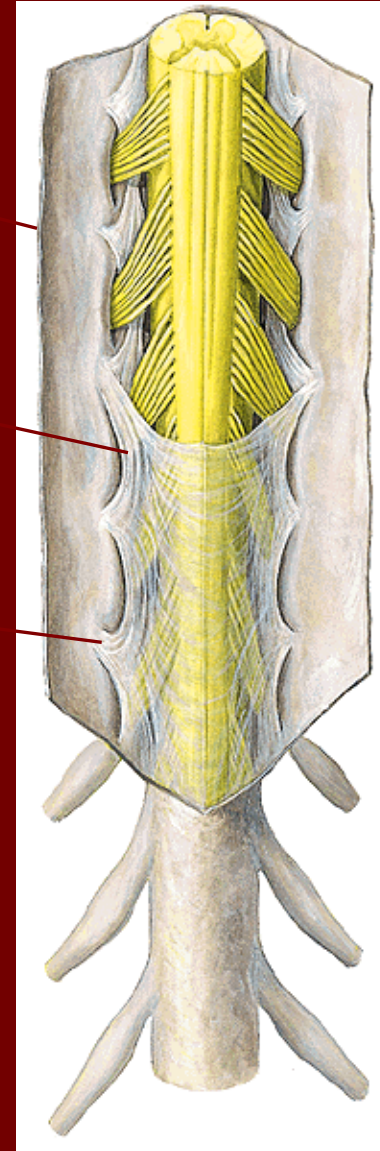
# MENINGES

Dura mater

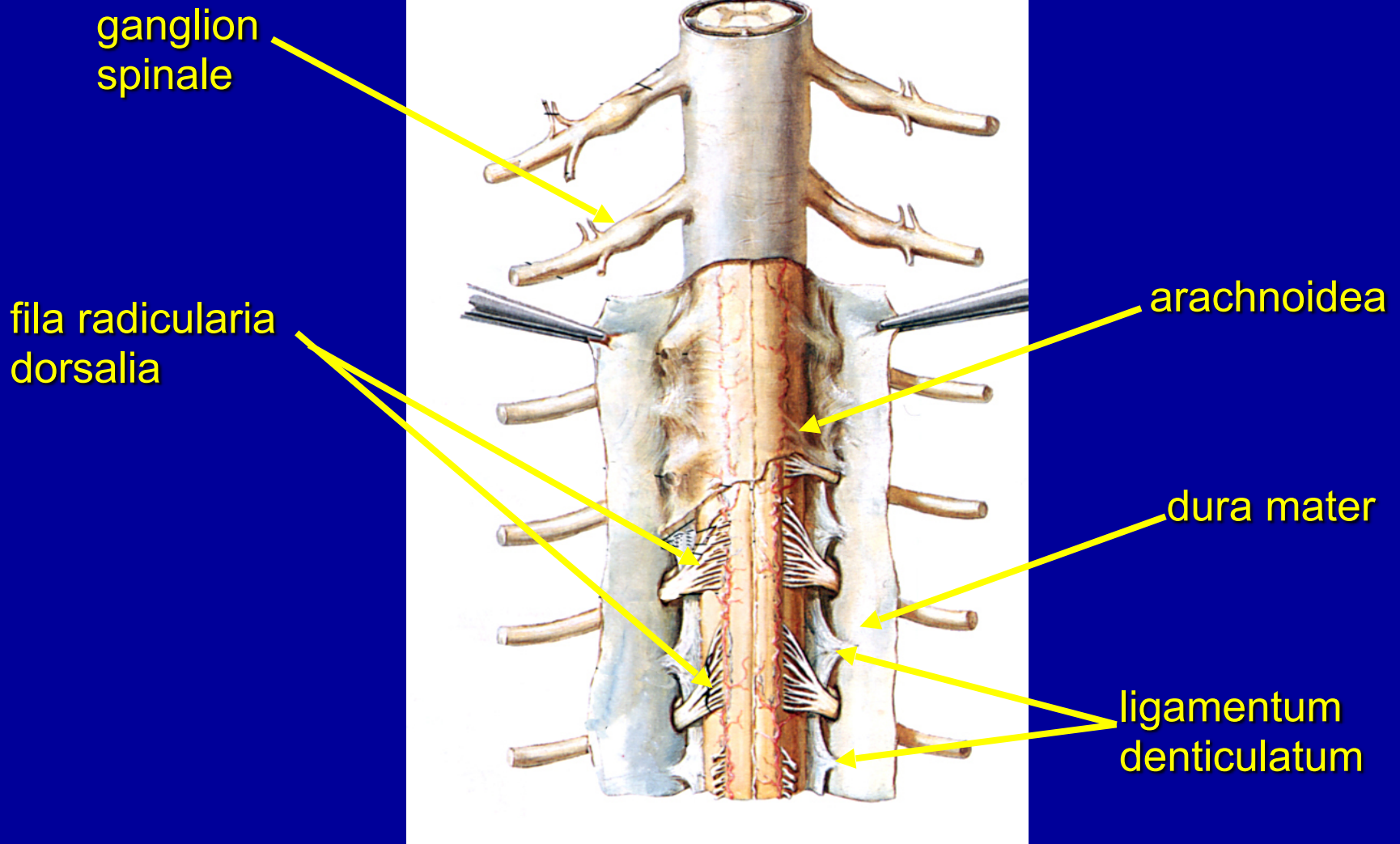
Arachnoid

Pia mater: Denticulate ligament

Pia mater pierces  
the arachnoid  
layer, attaches to  
the dura mater



# Meningeal layers of the spinal cord



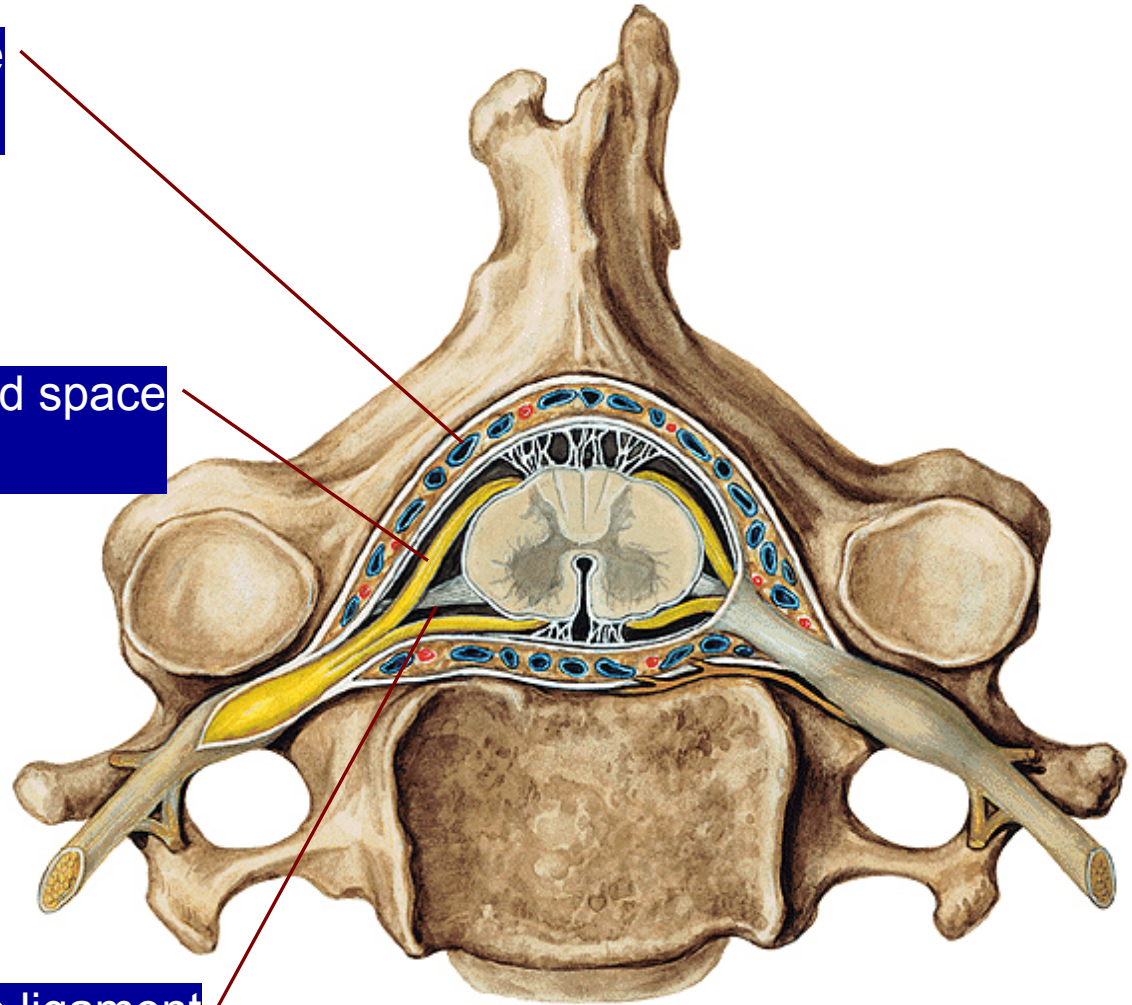


# MENINGES

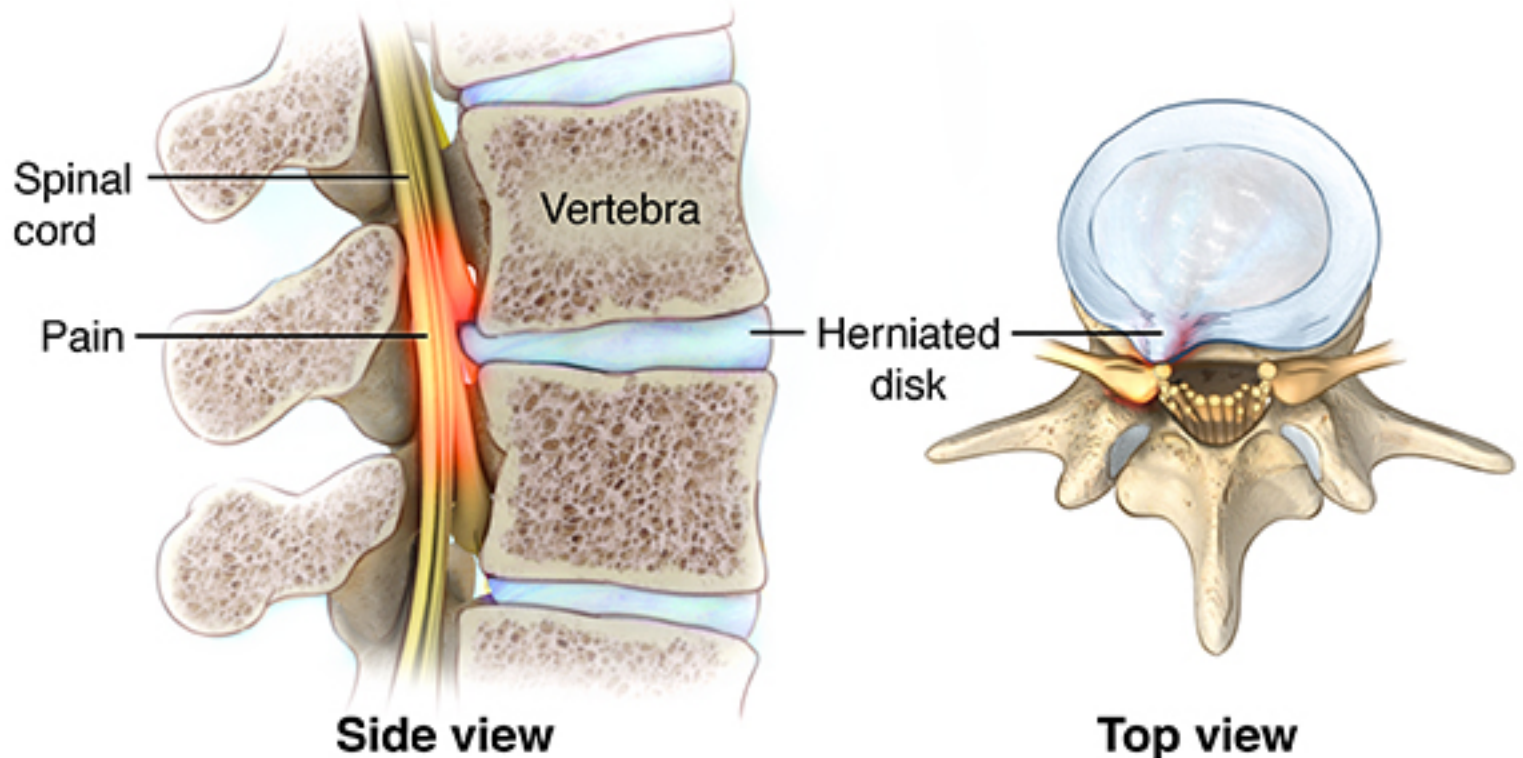
Epidural space

Subarachnoid space

Denticulate ligament



# Discus hernia



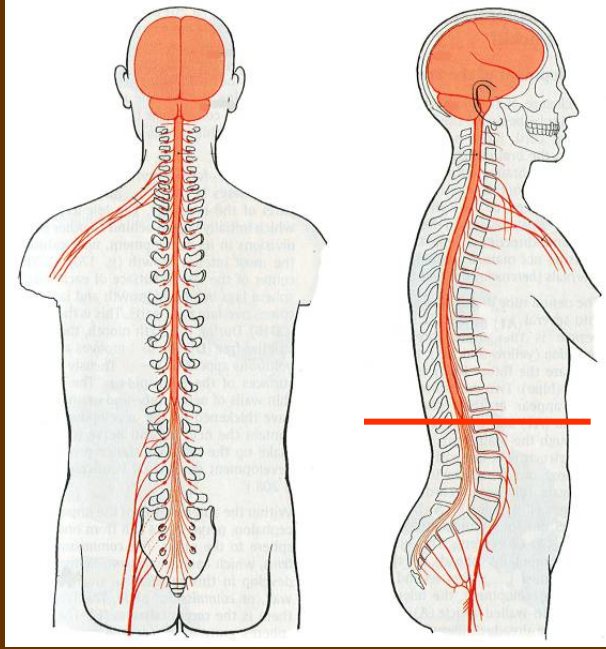
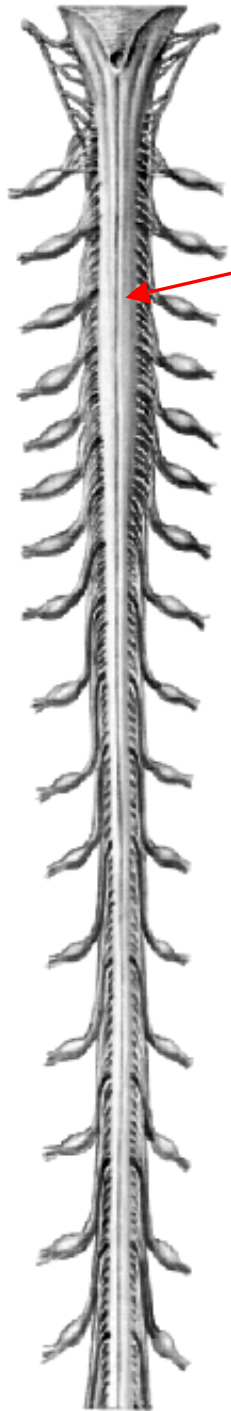
# MACROSCOPY

Enlargements

Cervical enlargement (C4-T1)  
Lumbosacral enlargement (L2-S3)

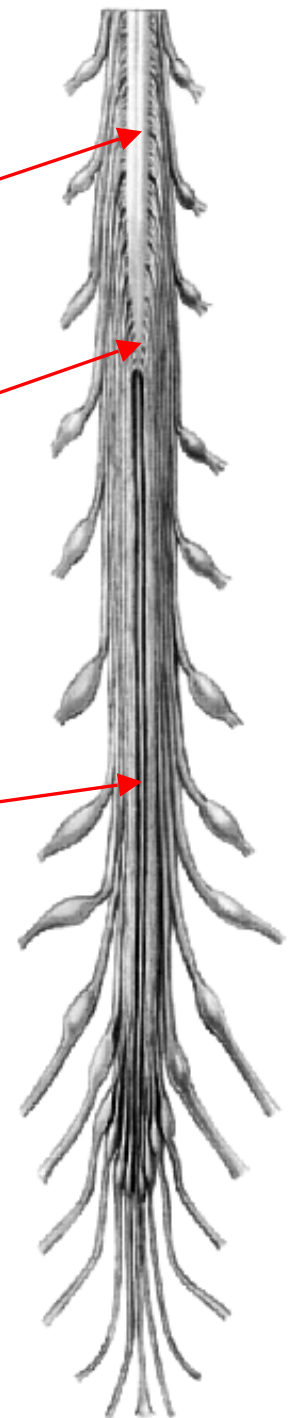
Conus terminalis

Cauda equina  
Filum terminale



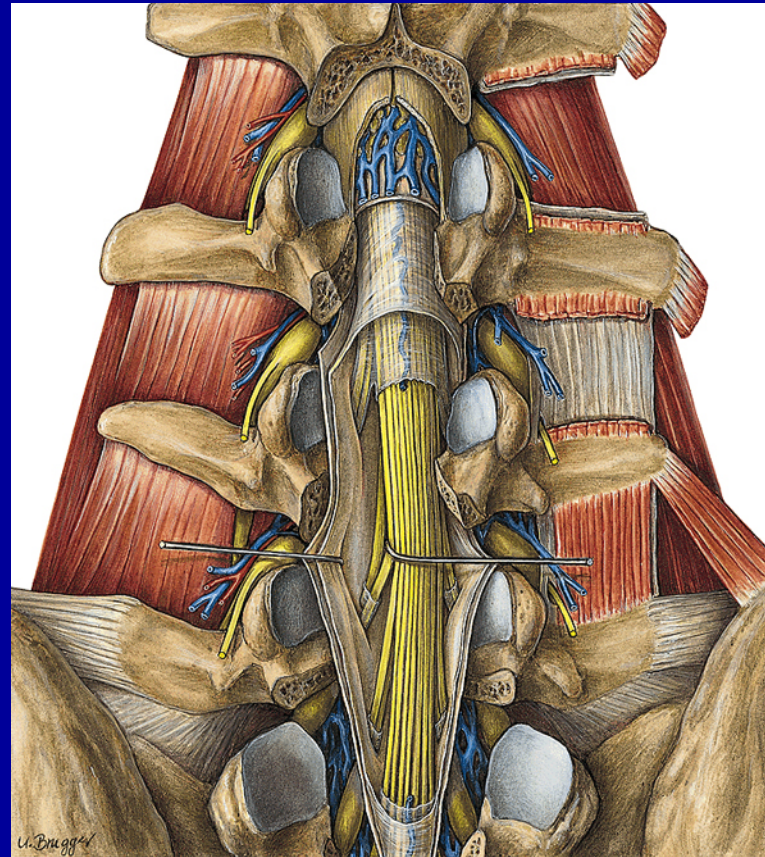
Central nervous system  
Brain  
Spinal cord

Peripheral nervous system  
Nerves  
Ganglia

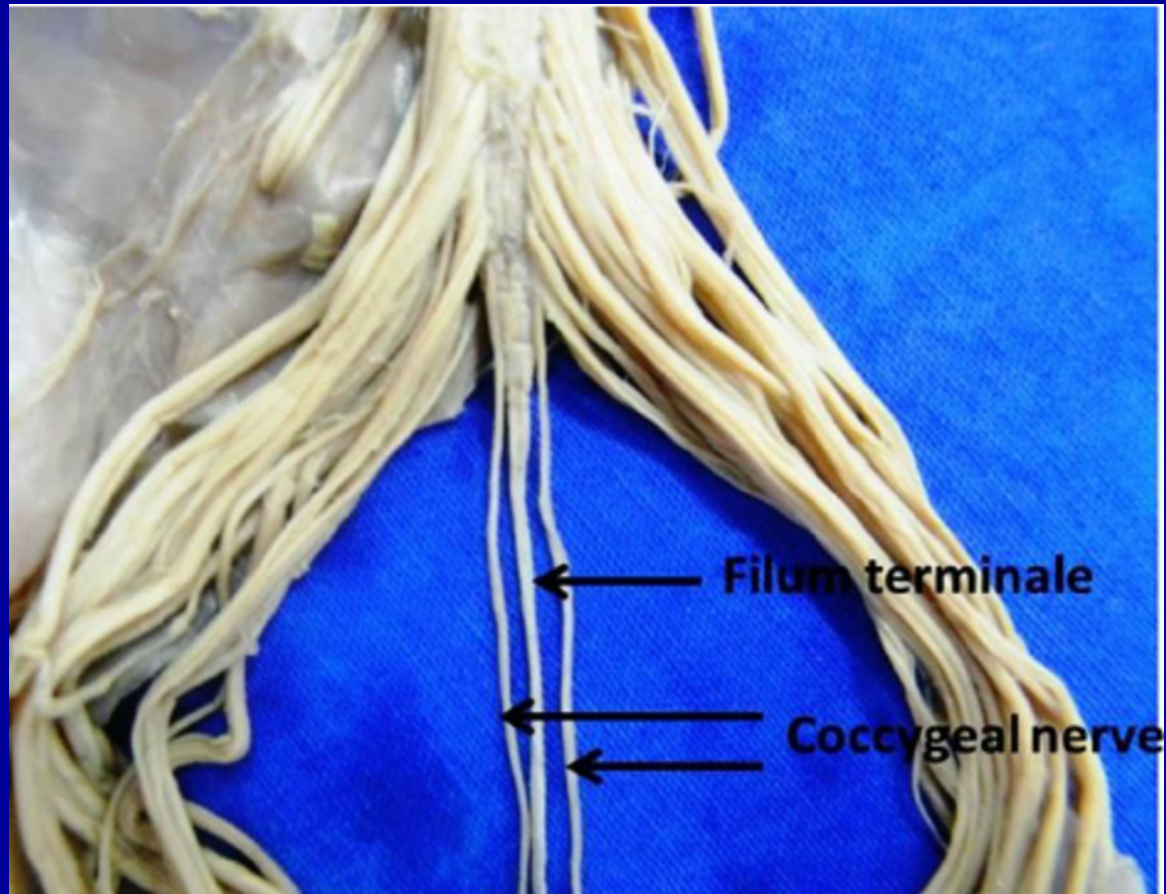




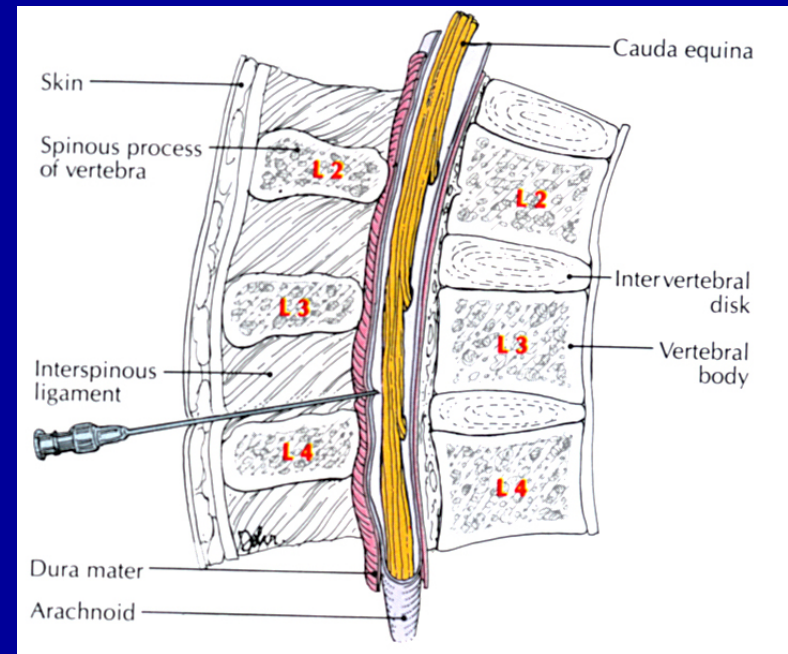
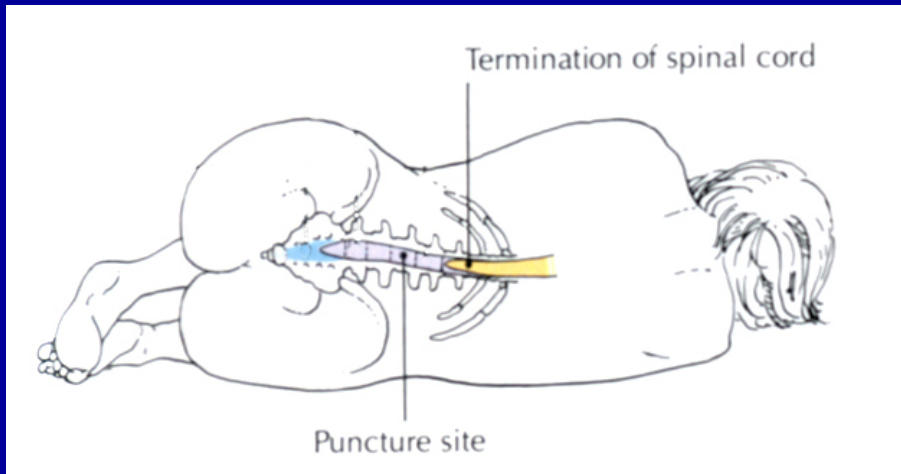
cauda equina



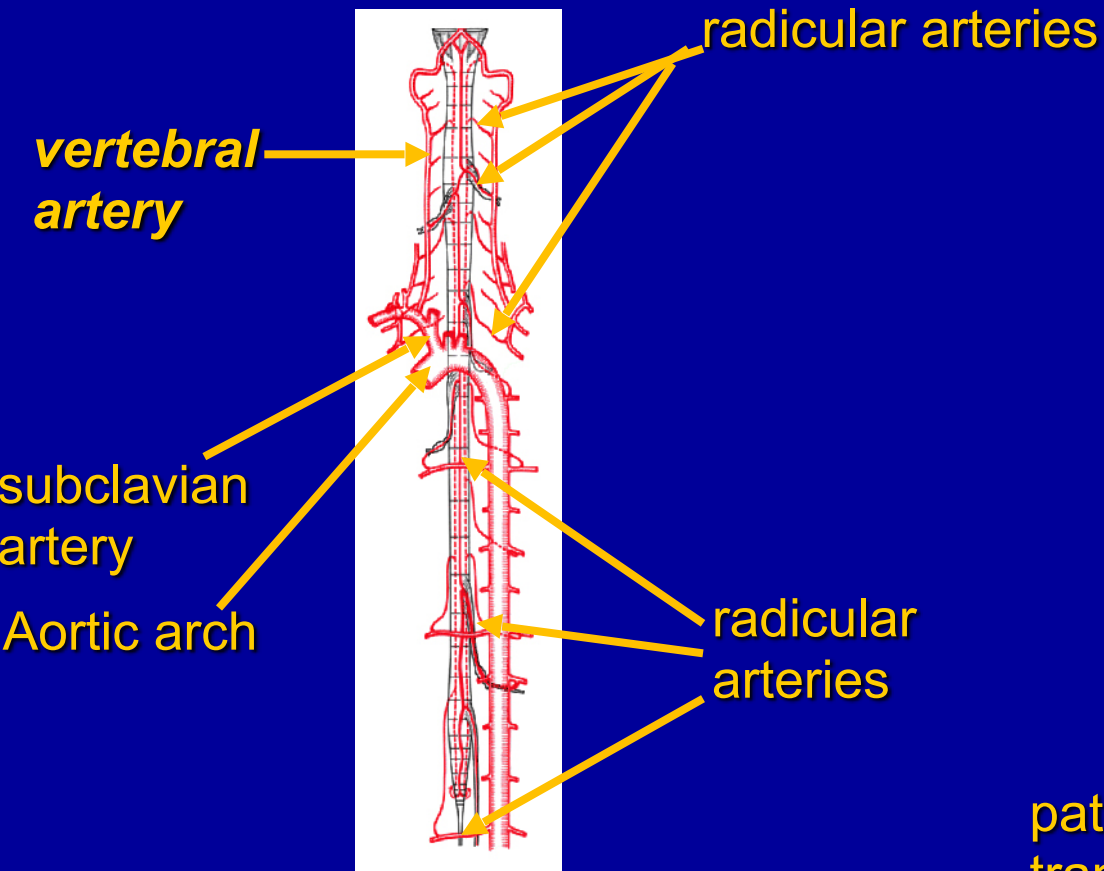
# Spinal cord



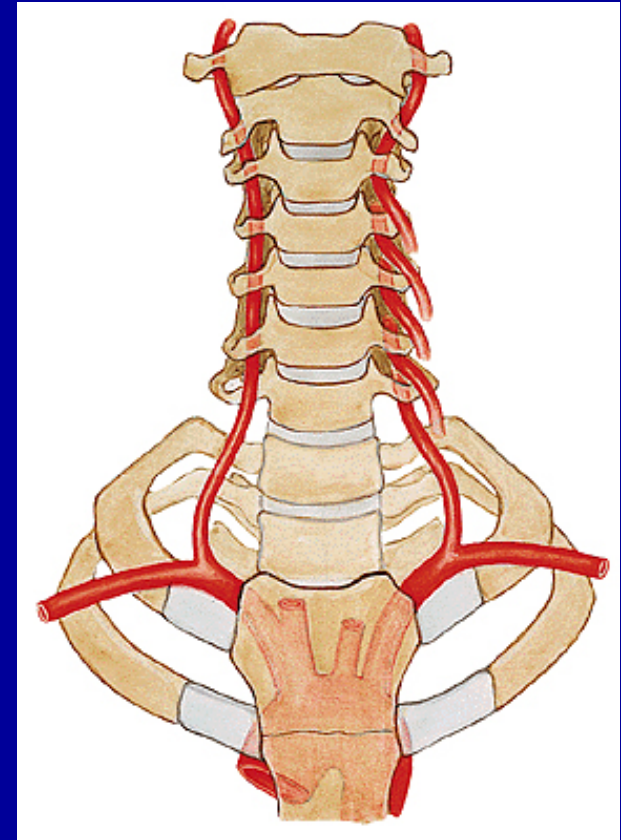
# Lumbar puncture



# Blodd supply of the spinal cord

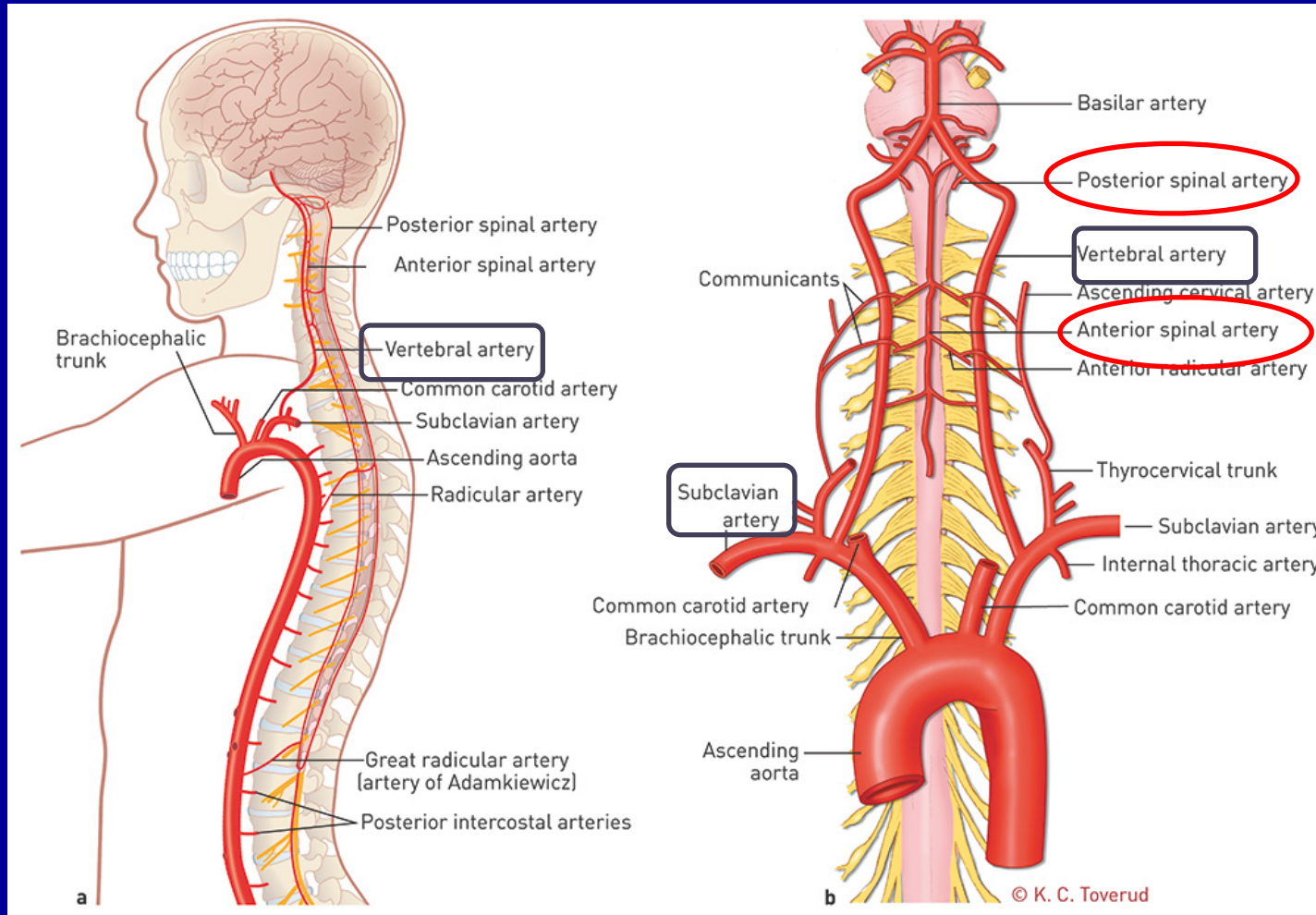


Radicular arteries: complete the blood supply of the spinal cord



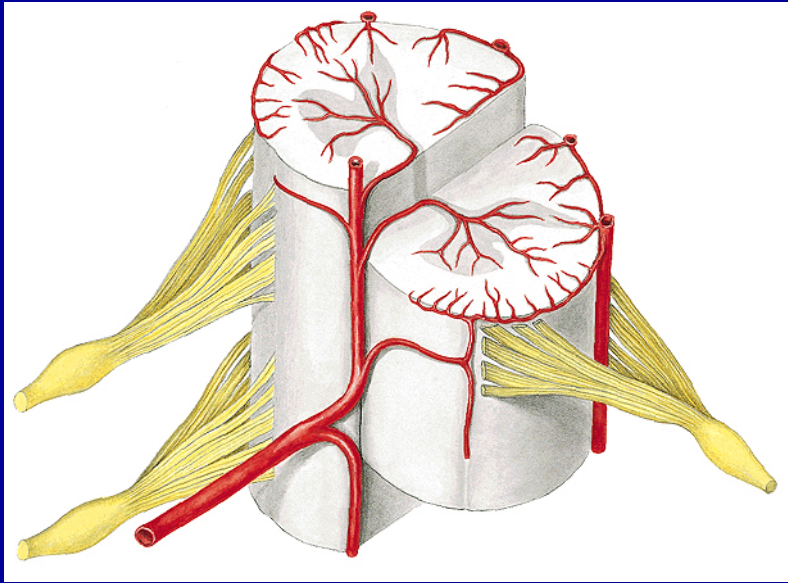
pathway of the vertebral artery:  
transverse foramina  
of the cervical vertebrae

# Blood supply of the spinal cord





# Vasocorona medullaris



## Vertebral artery:

- a. spinalis anterior (united: 1)
- a. spinalis posterior (2)

## Radicular arteries:

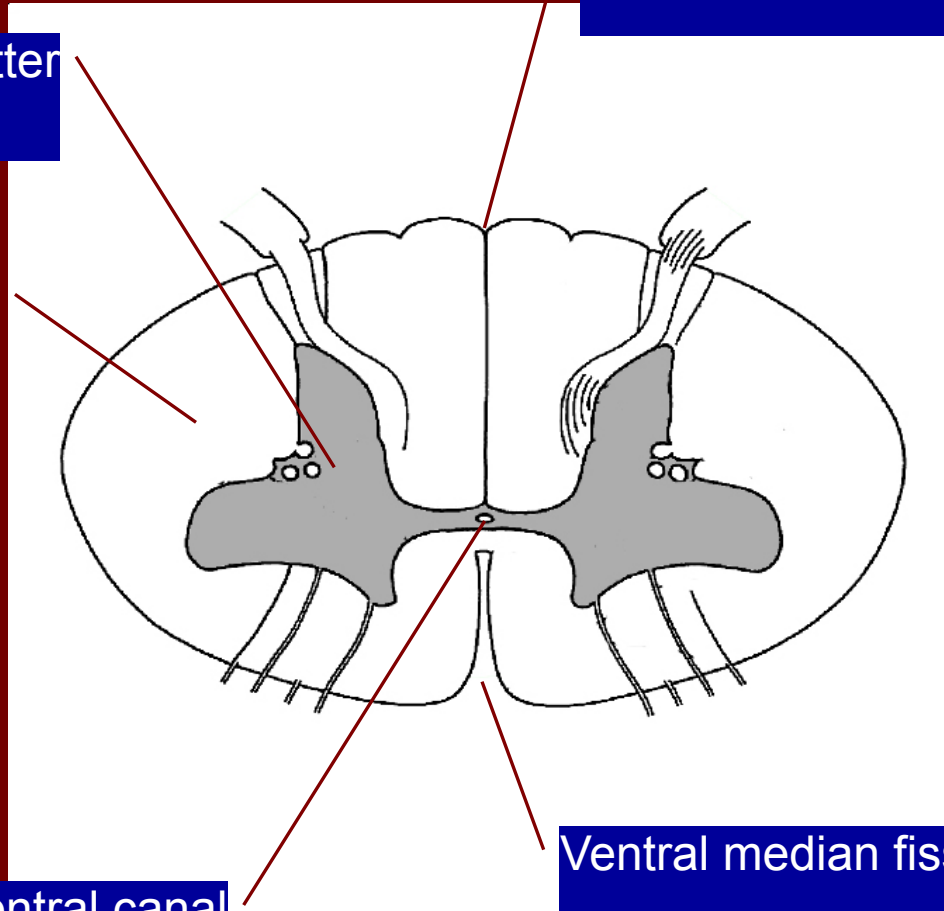
- cervical: vertebral a.  
ascending. cerv. a.  
deep cerv. a.
- thoracal: intercostal aa.
- lumbal: lumbal aa.
- sacral: lateral sacr. art.

# CROSS SECTION

Dorsal median sulcus

Gray matter

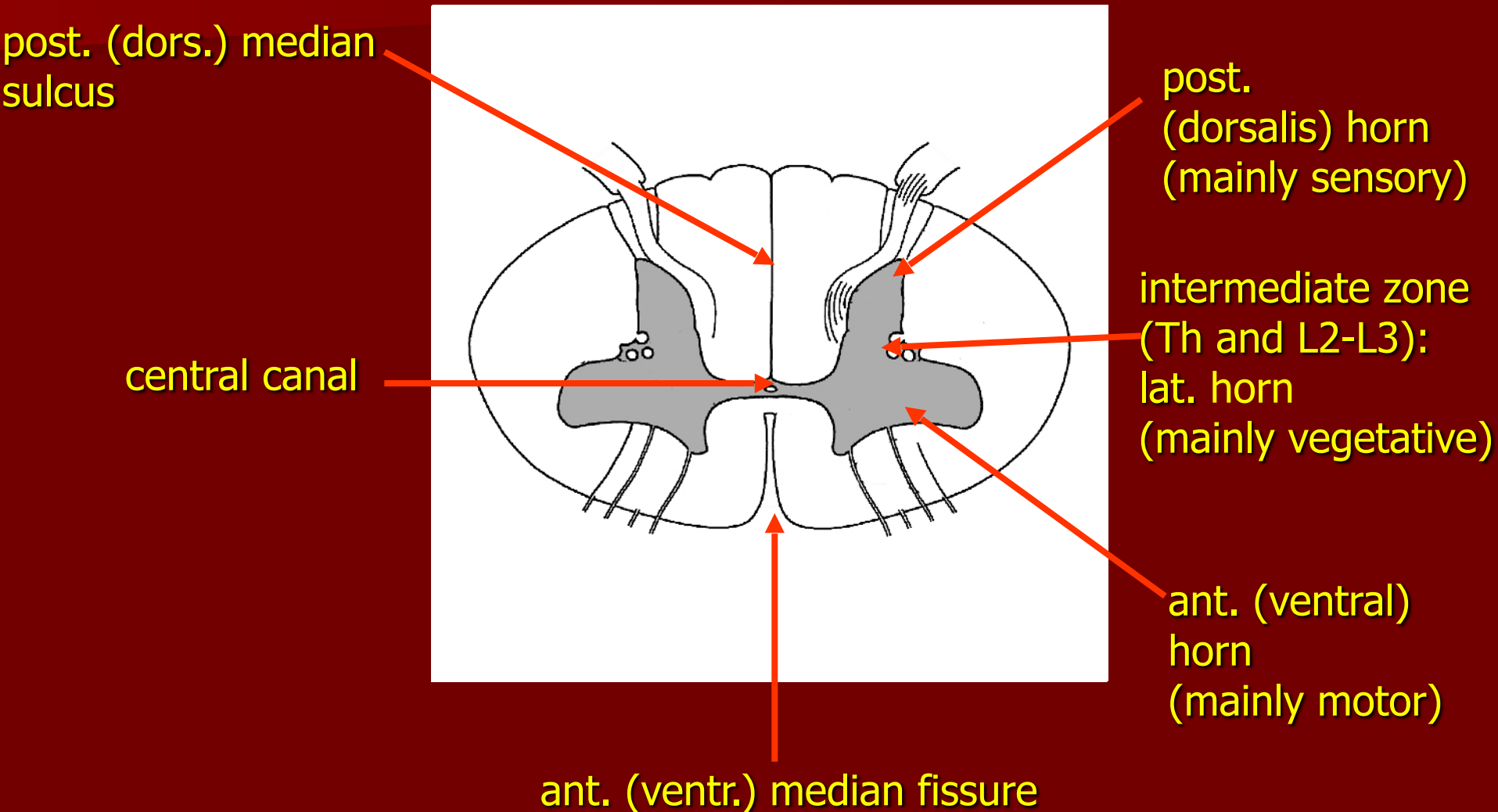
White matter



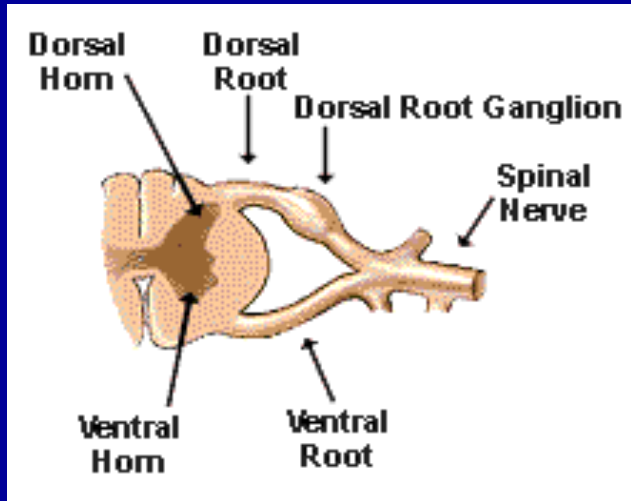
Central canal

Ventral median fissure

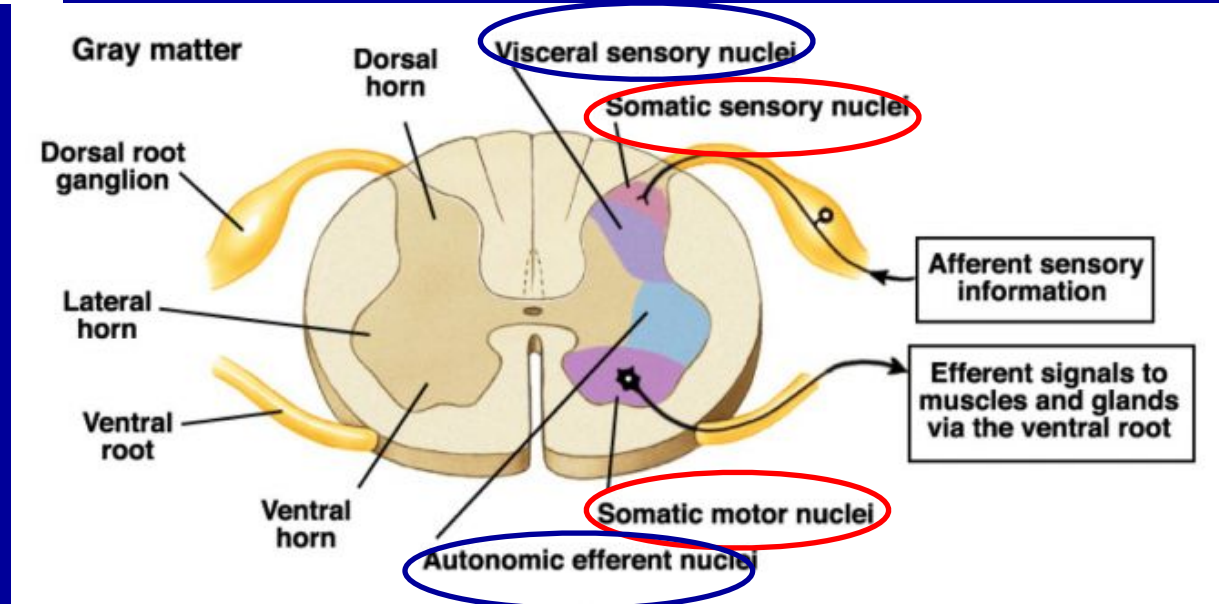
# Cross section of the spinal cord



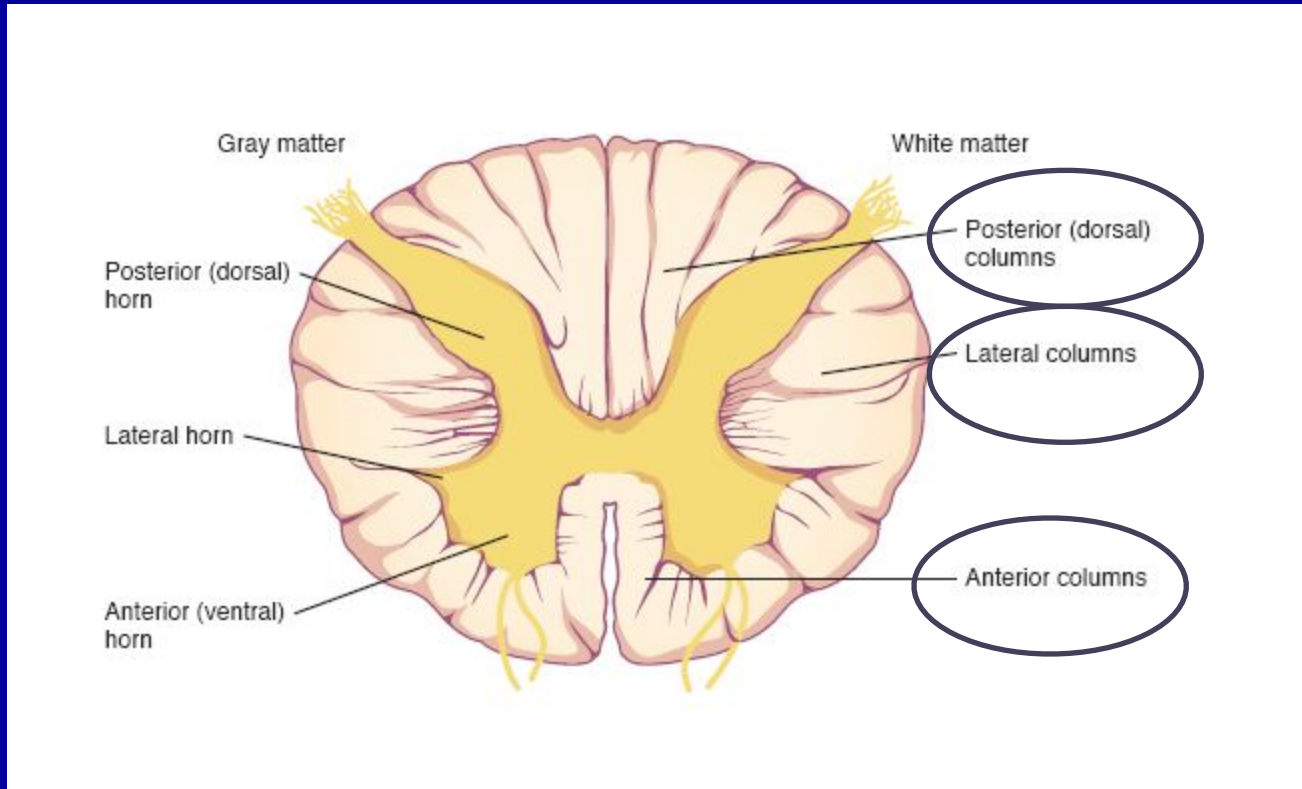
# Spinal cord



Sensory ganglion; pseudounipolar cells inside

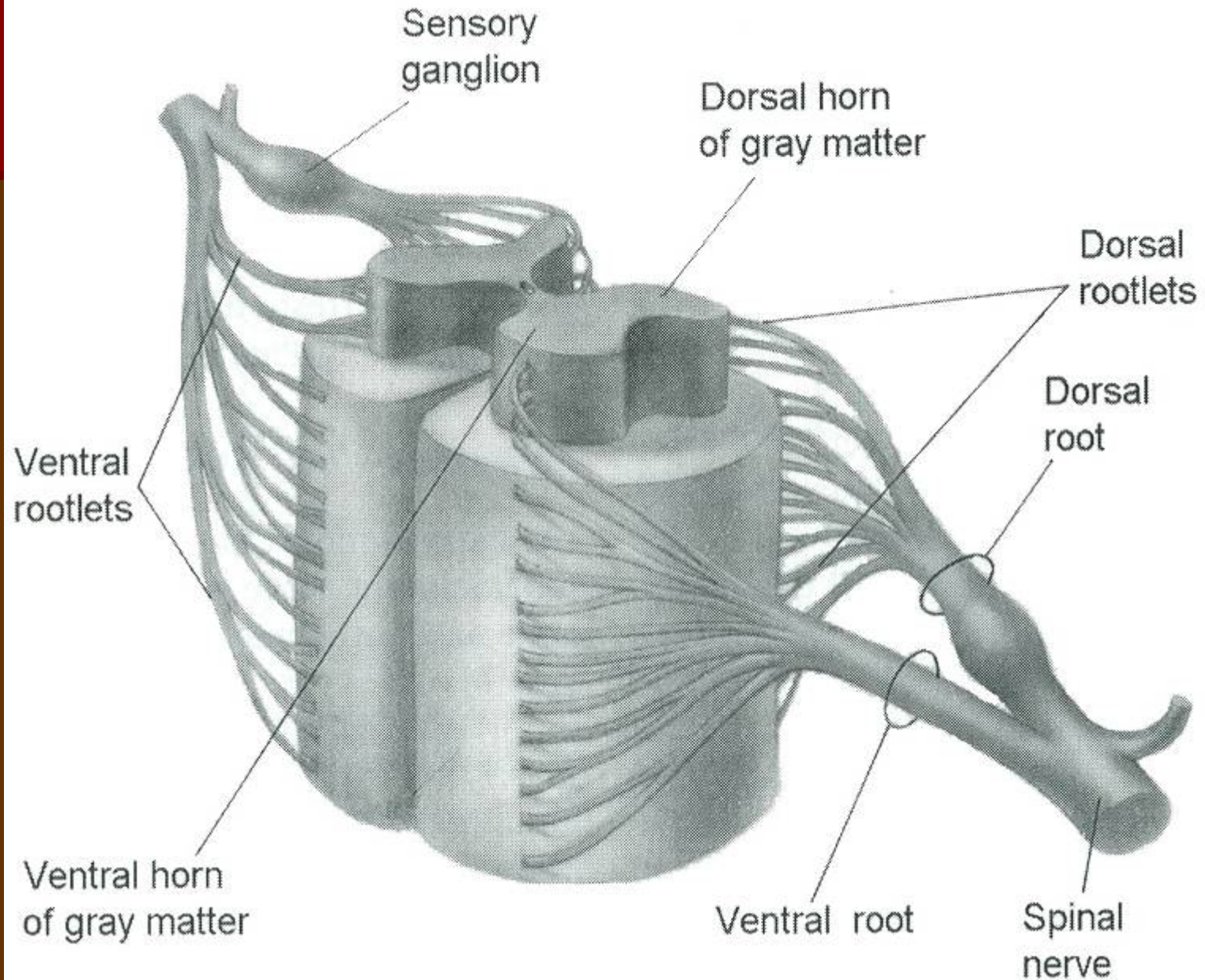


# Spinal cord

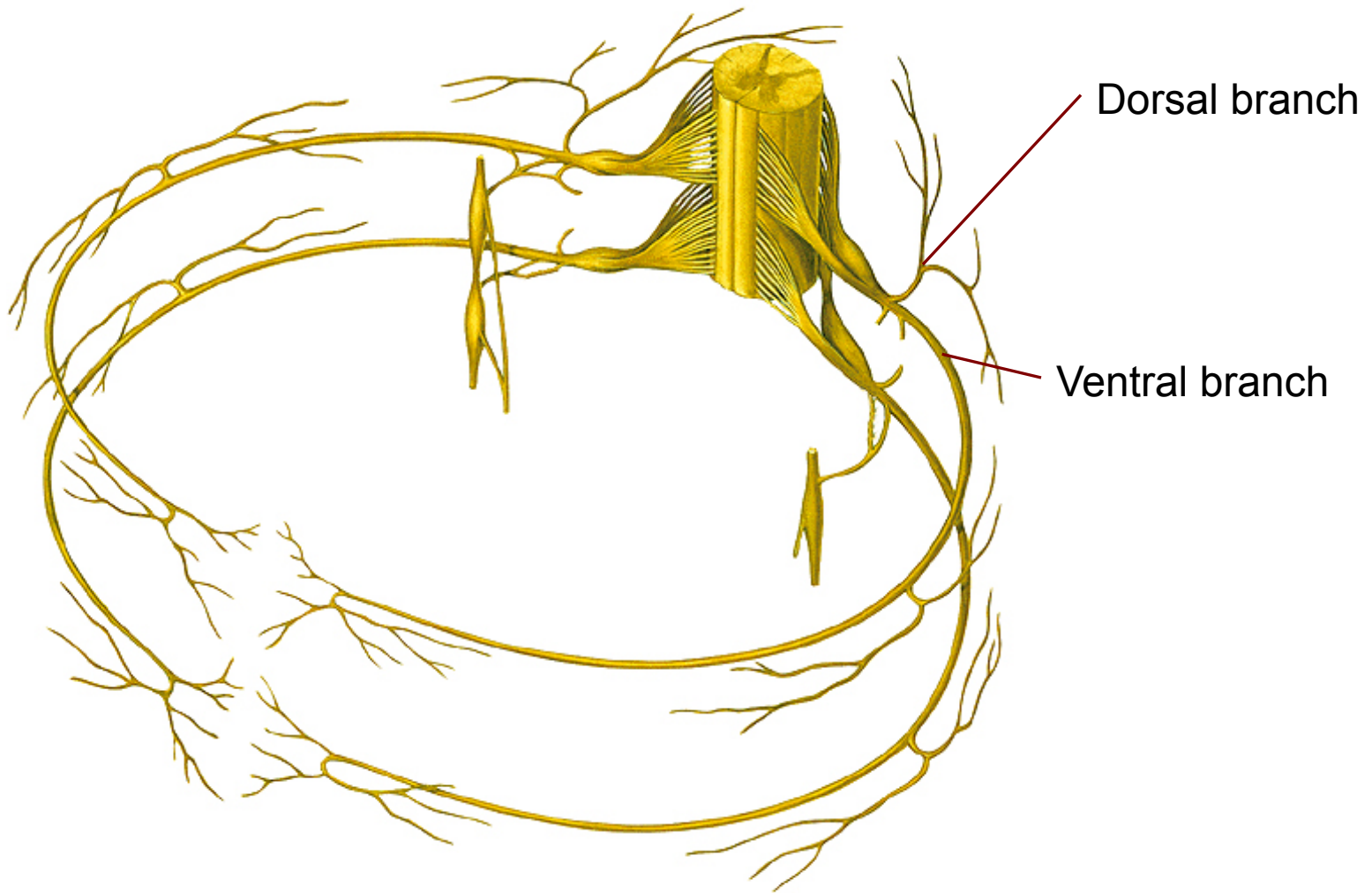


Dorsal column (posterior): mainly sensory pathways  
Ventral column (anterior): mainly motor pathways  
Lateral column: mainly vegetativ pathways

# SPINAL CORD SEGMENT



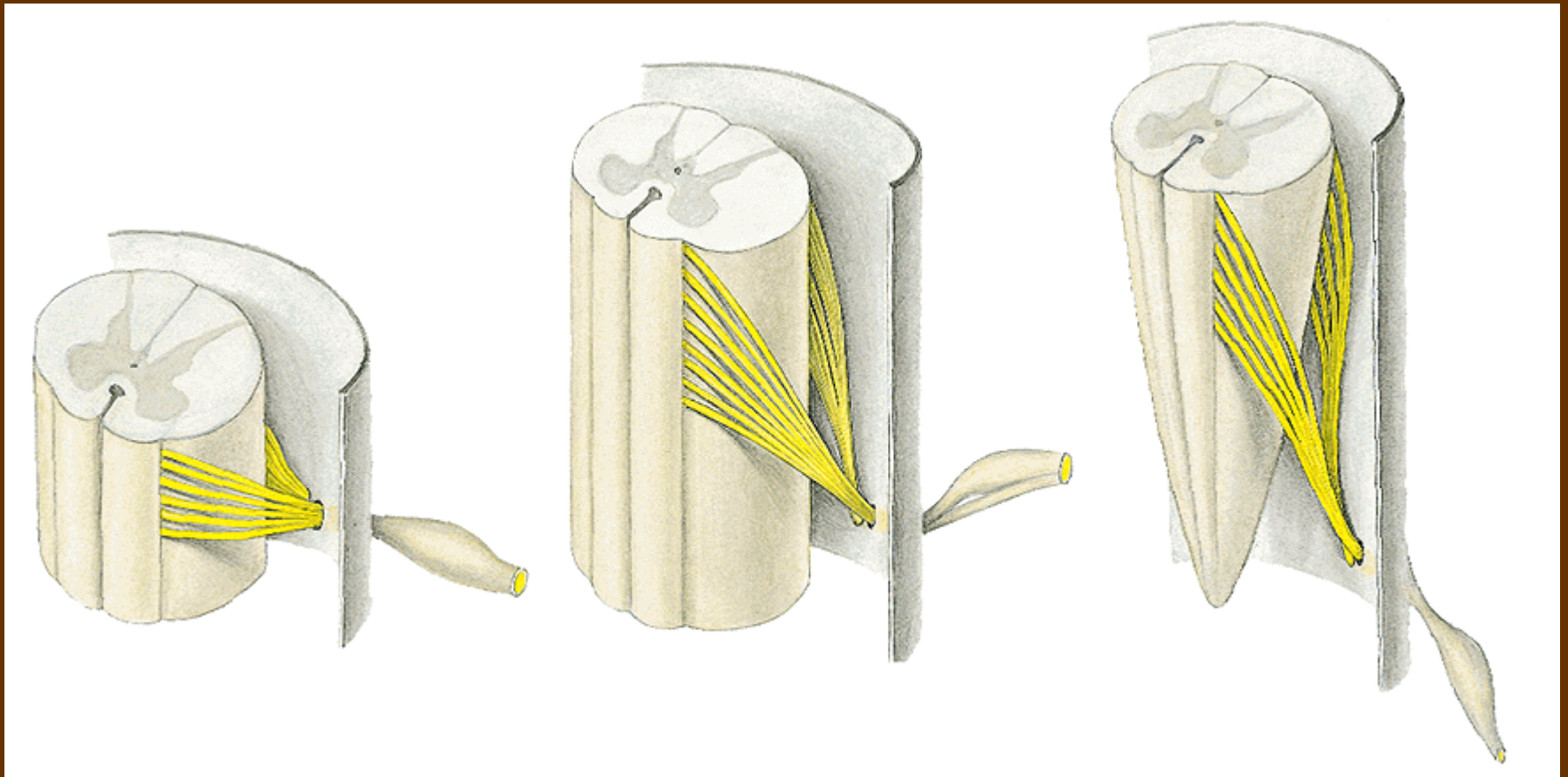
# SPINAL NERVES



# SPINAL CORD SEGMENTS

Spinal cord ends at the level of the L1 vertebra in adults

Lumbar and sacral roots travel several vertebrae down:  
cauda equina





# SPINAL CORD SEGMENTS

## Number of segments:

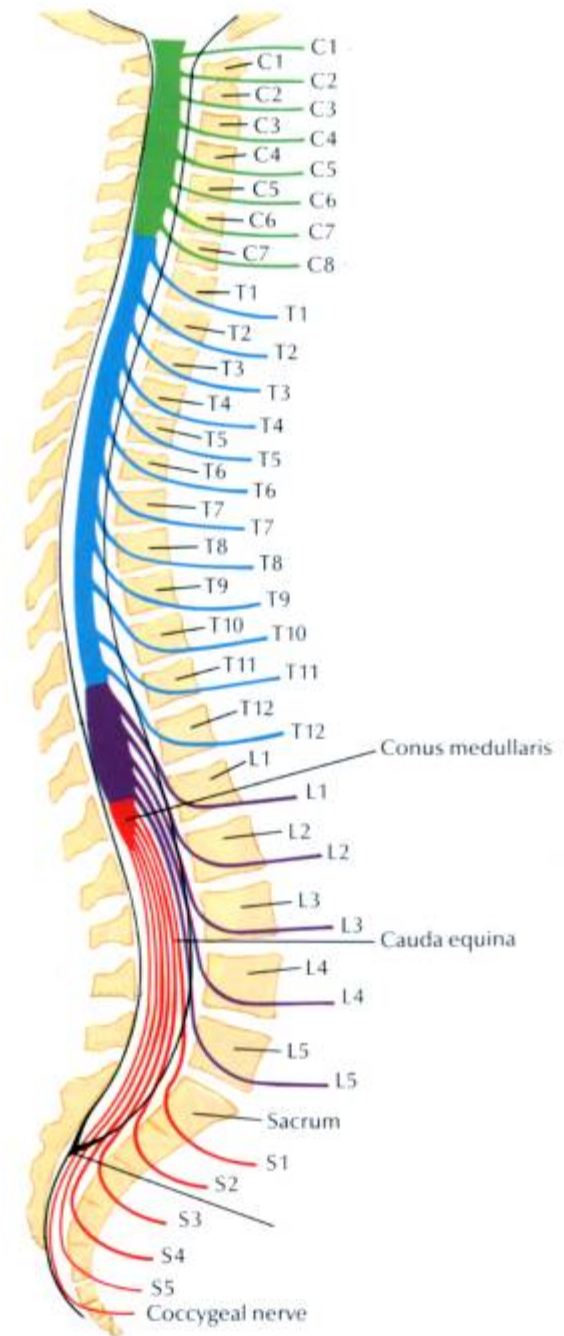
8 cervical (!)

12 thoracic

5 lumbar

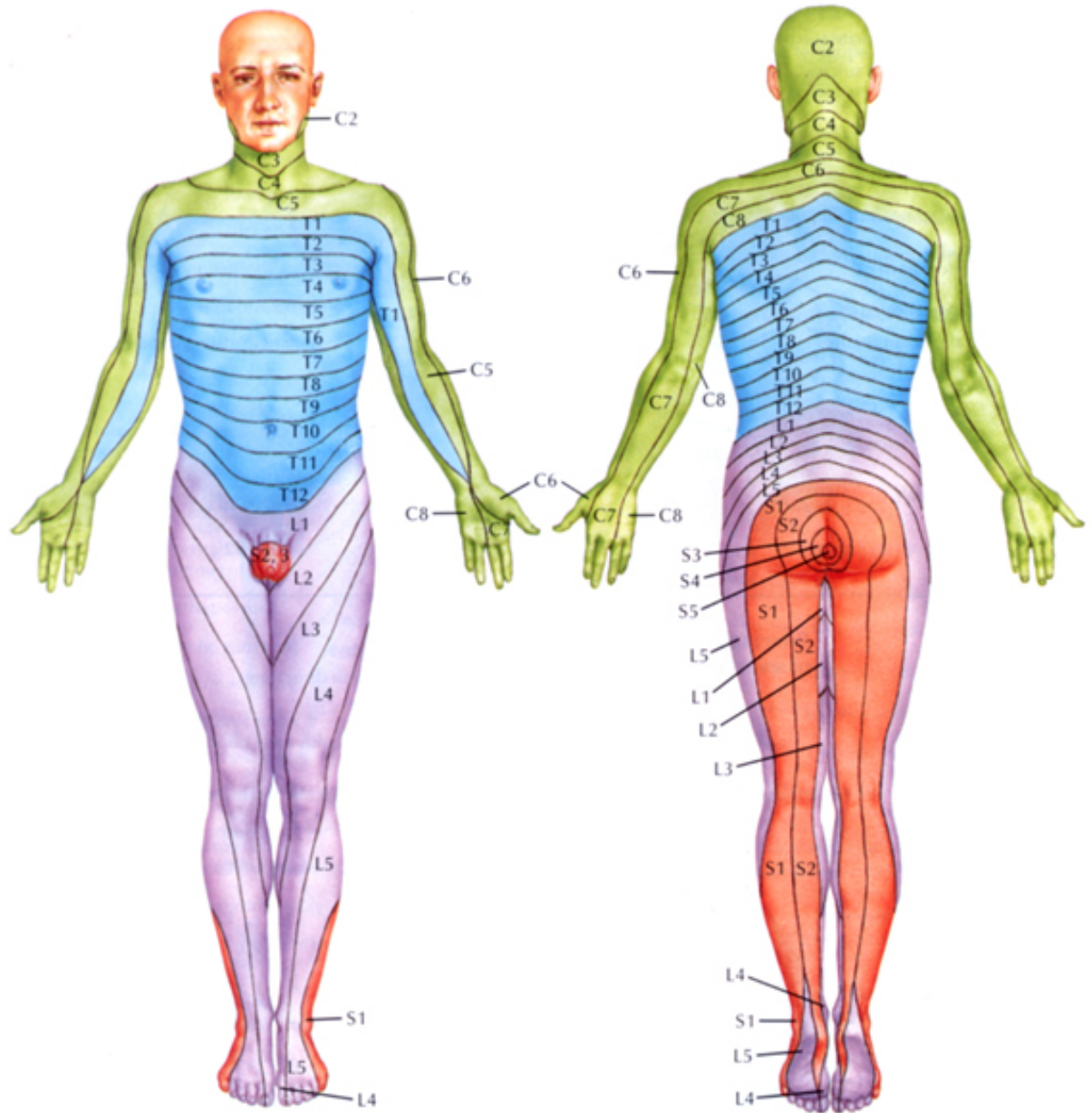
5 sacral

1 coccygeal



# SEGMENTAL INNERVATION

Dermatomes:  
segmental symptoms



# CERVICAL PLEXUS AND BRACHIAL PLEXUS

Cervical plexus (C1-4):

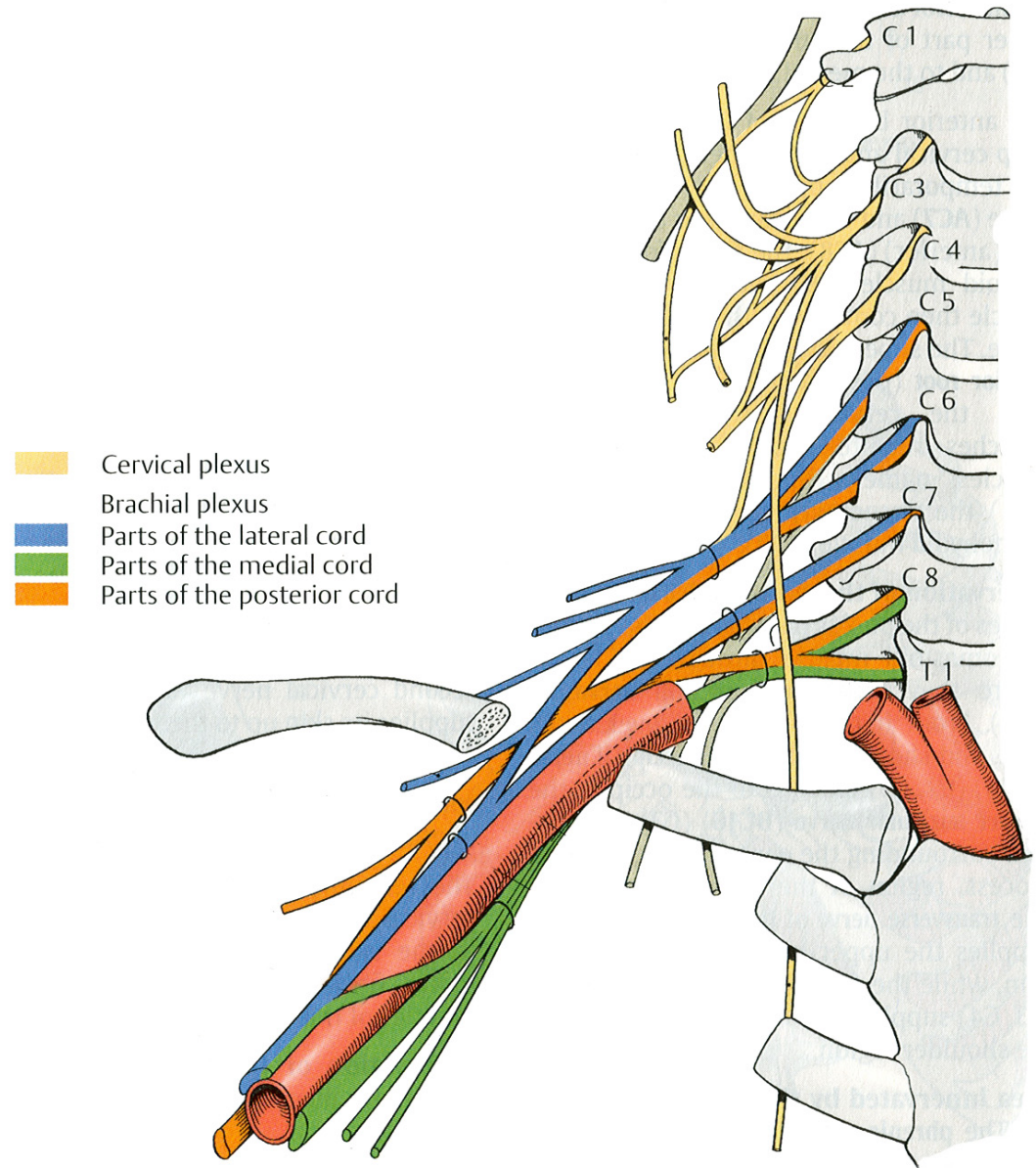
*Phrenic nerve*

Brachial plexus (C5-T1):

Superior trunk (C5-6)

Middle trunk (C7)

Inferior trunk (C8-T1)



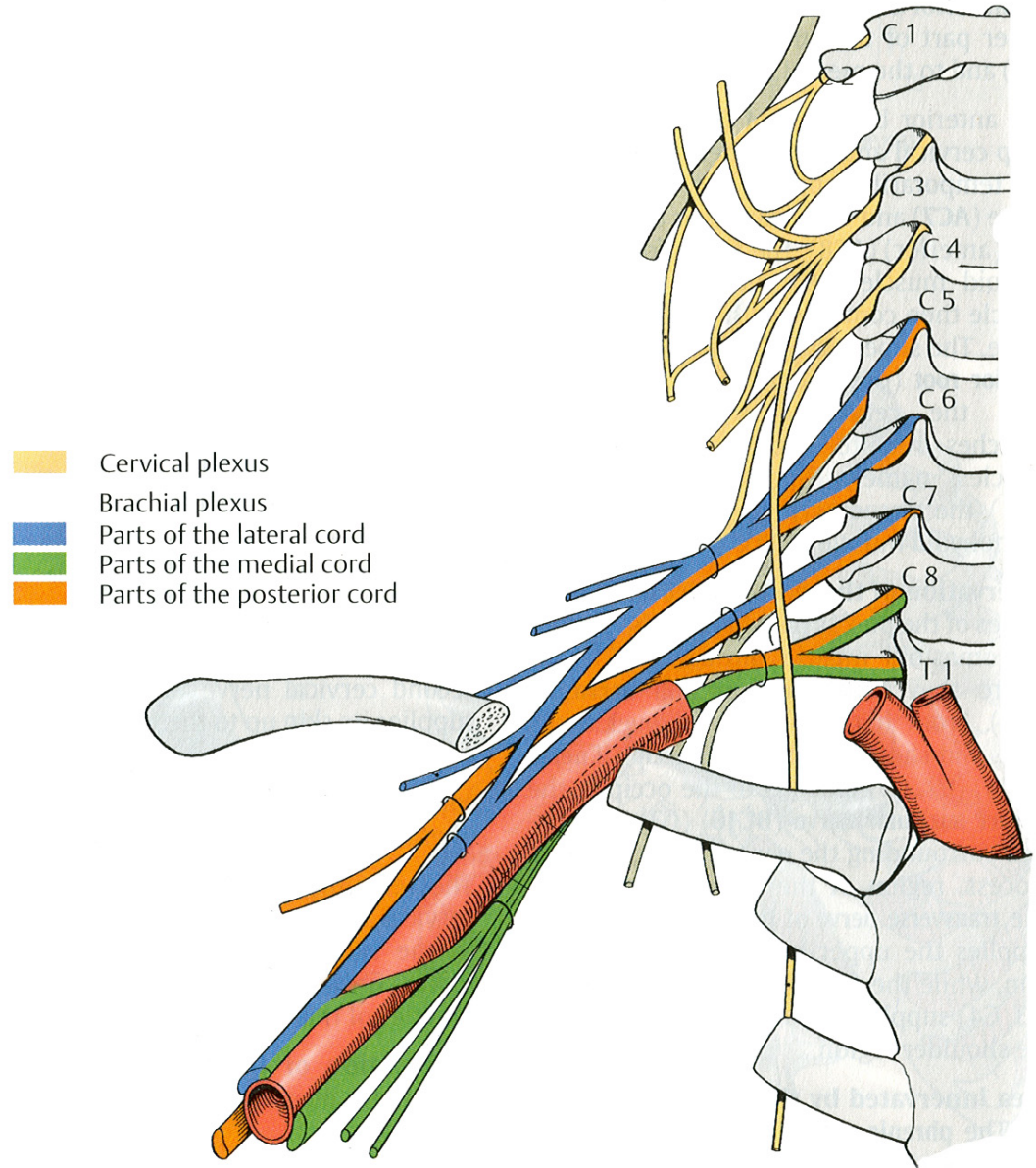
# CERVICAL PLEXUS AND BRACHIAL PLEXUS

Brachial plexus (C5-T1):

Lateral cord (C5-7)

Medial cord (C8-T1)

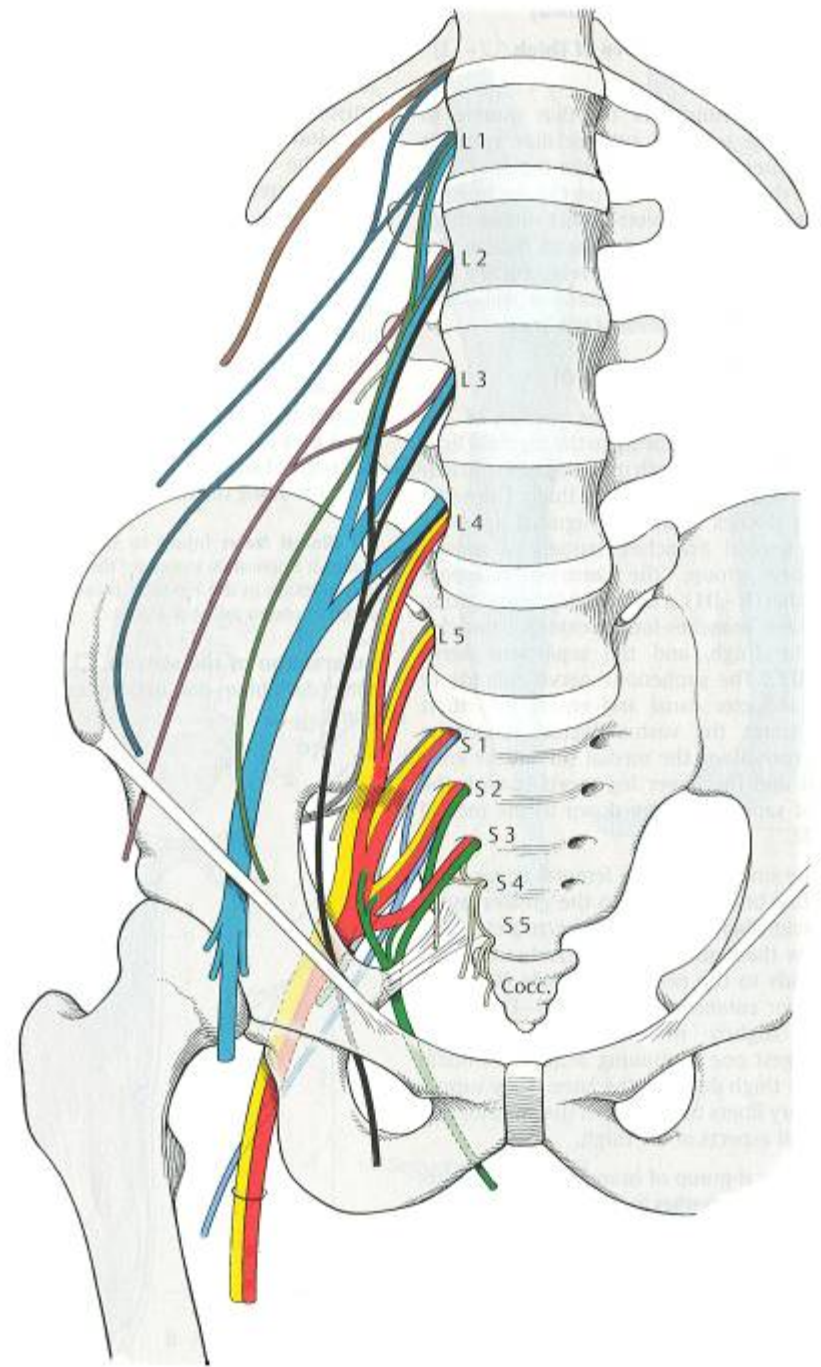
Posterior cord (C5-T1)



# LUMBOSACRAL PLEXUS

Lumbar plexus (T12-L4):

Sacral plexus (L4-S3):



# Brain

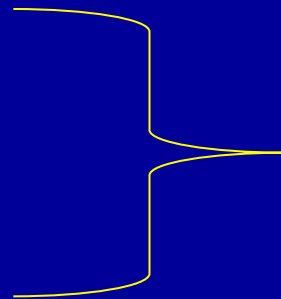


# Brain

Medulla oblongata

Pons

Midbrain (mesencephalon)



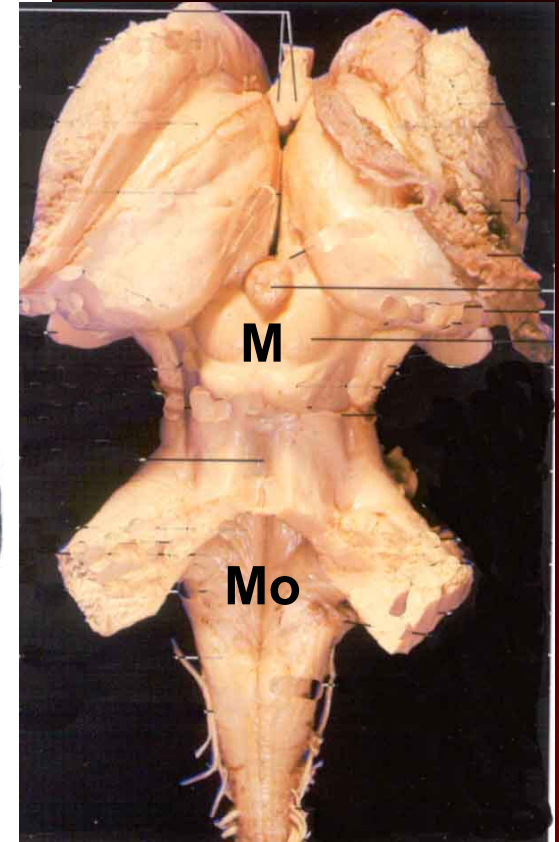
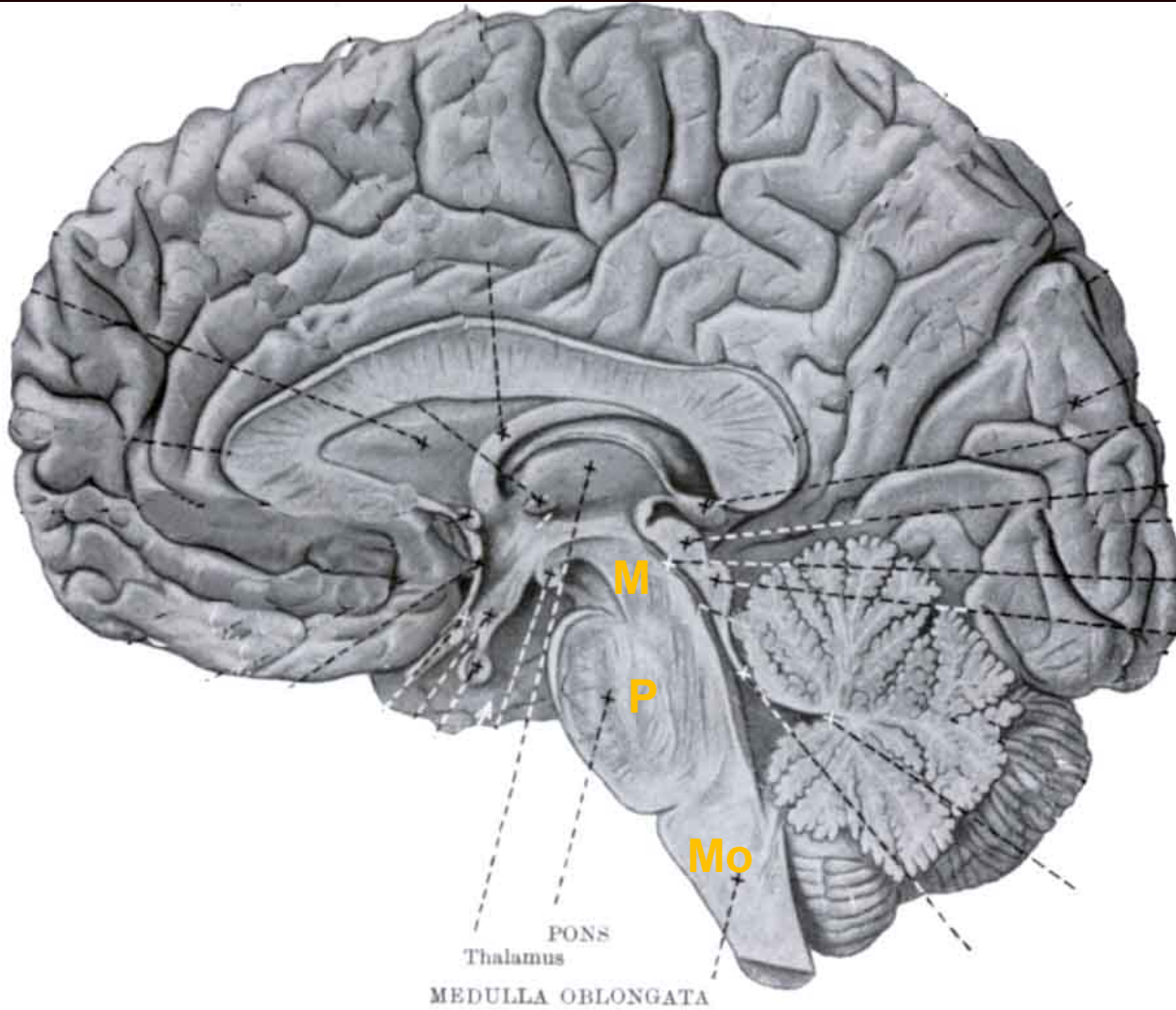
Brain stem

Cerebellum

Diencephalon (thalamus, hypothalamus,  
hypophysis)

Cerebrum

# MEDIANSAGITTAL SECTION OF THE BRAIN STEM





# Meningeal layers of the brain

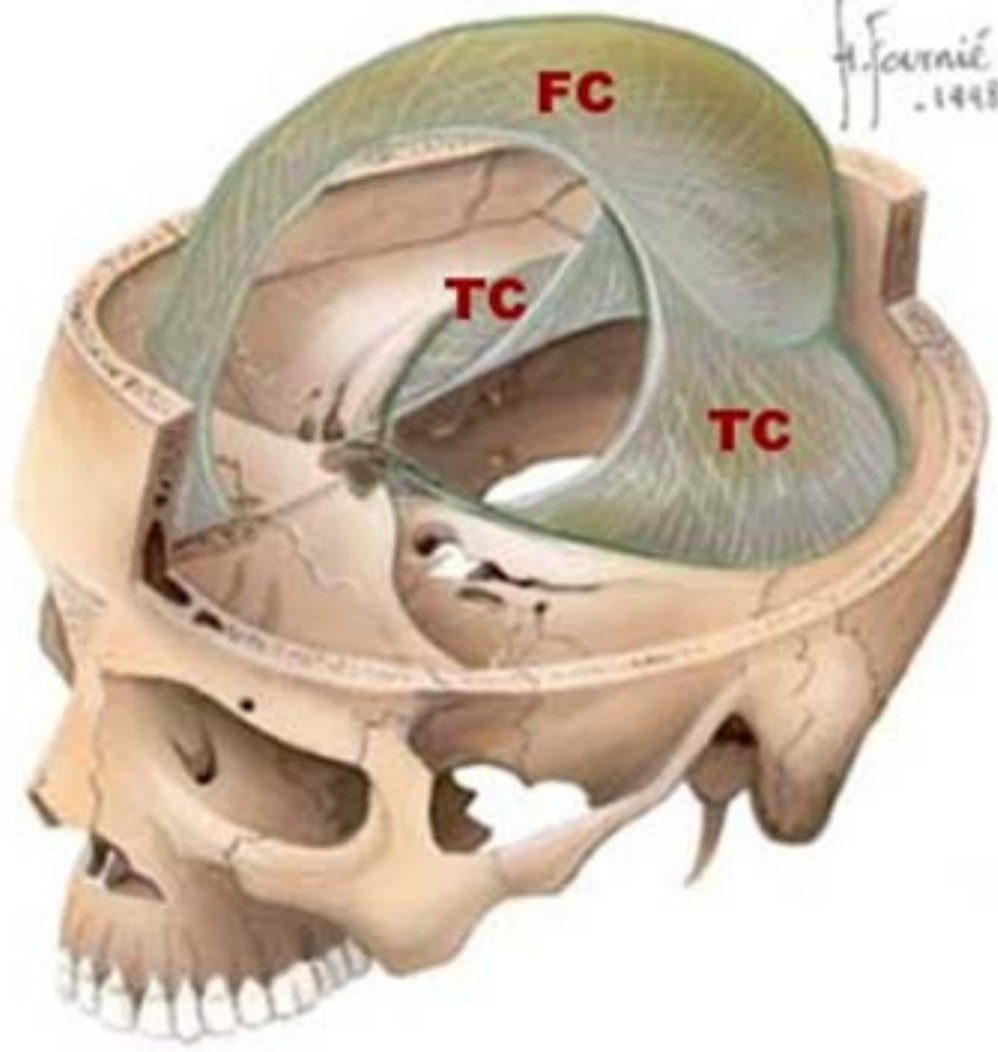
Dura mater:

falx cerebri, tentorium cerebelli, falx cerebelli

sinuses: venous blood

Arachnoid layer: cisterns CSF

Pia mater: blood vessels



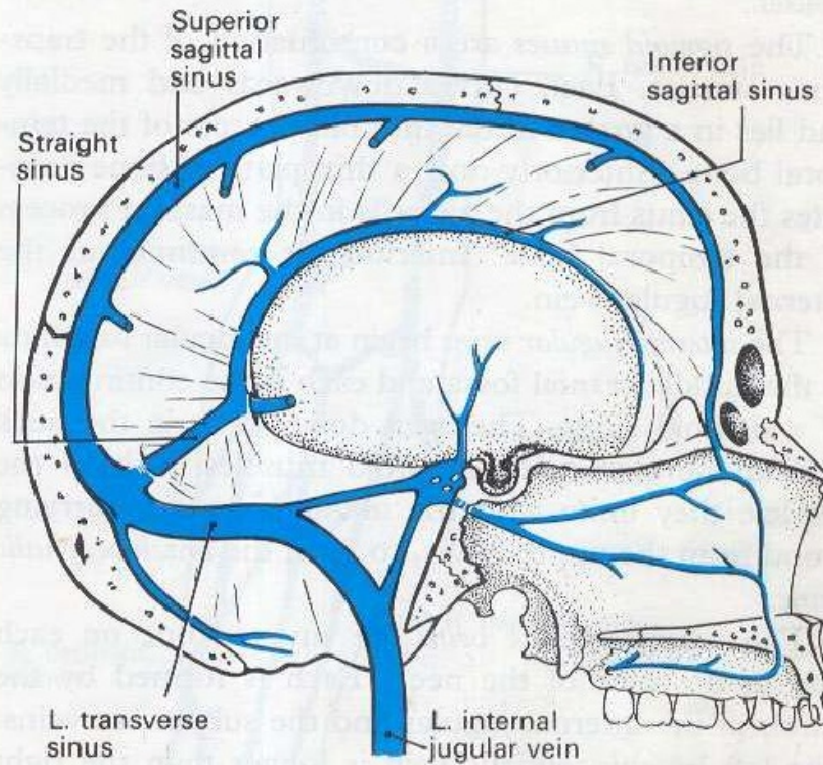
H. Fournié  
-1948

**FC**

**TC**

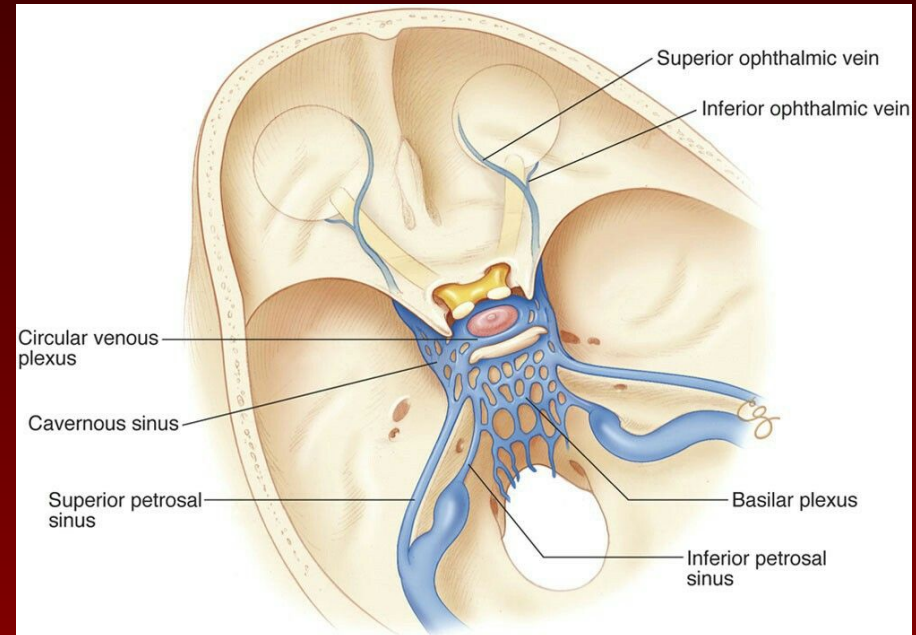
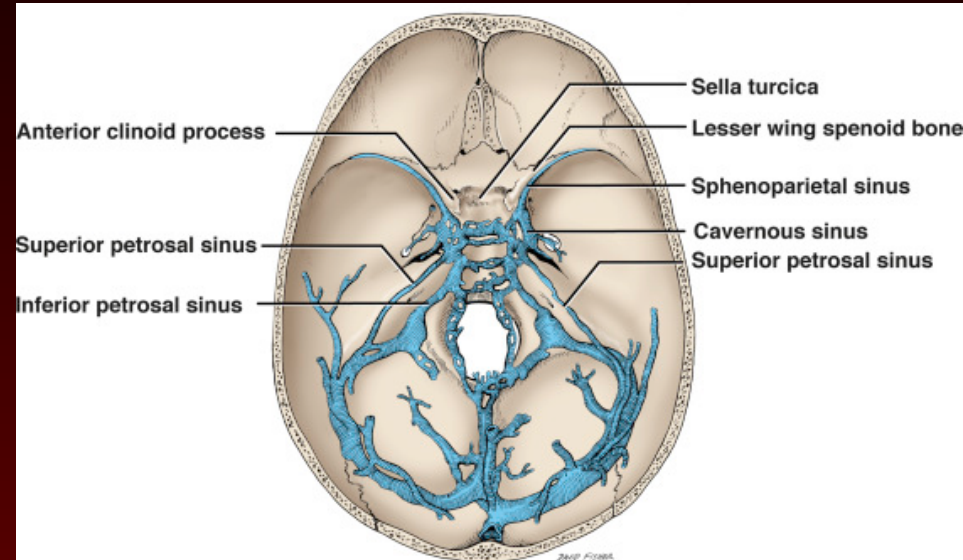
**TC**

# Unpaired dural sinuses



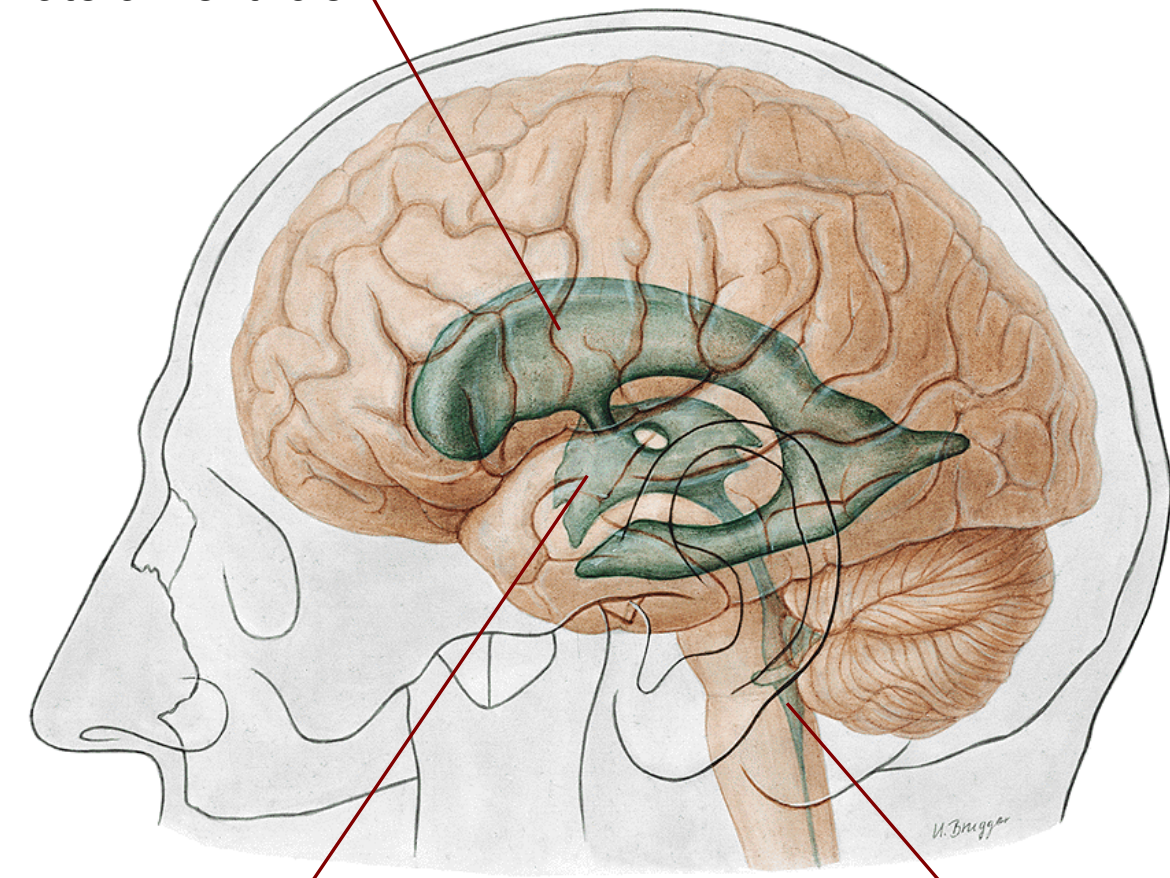
**Figure 5.35** Venous sinuses of the brain viewed from the right side.

# Paired dural sinuses



# VENTRICLES

Lateral ventricle



3rd ventricle

4th ventricle

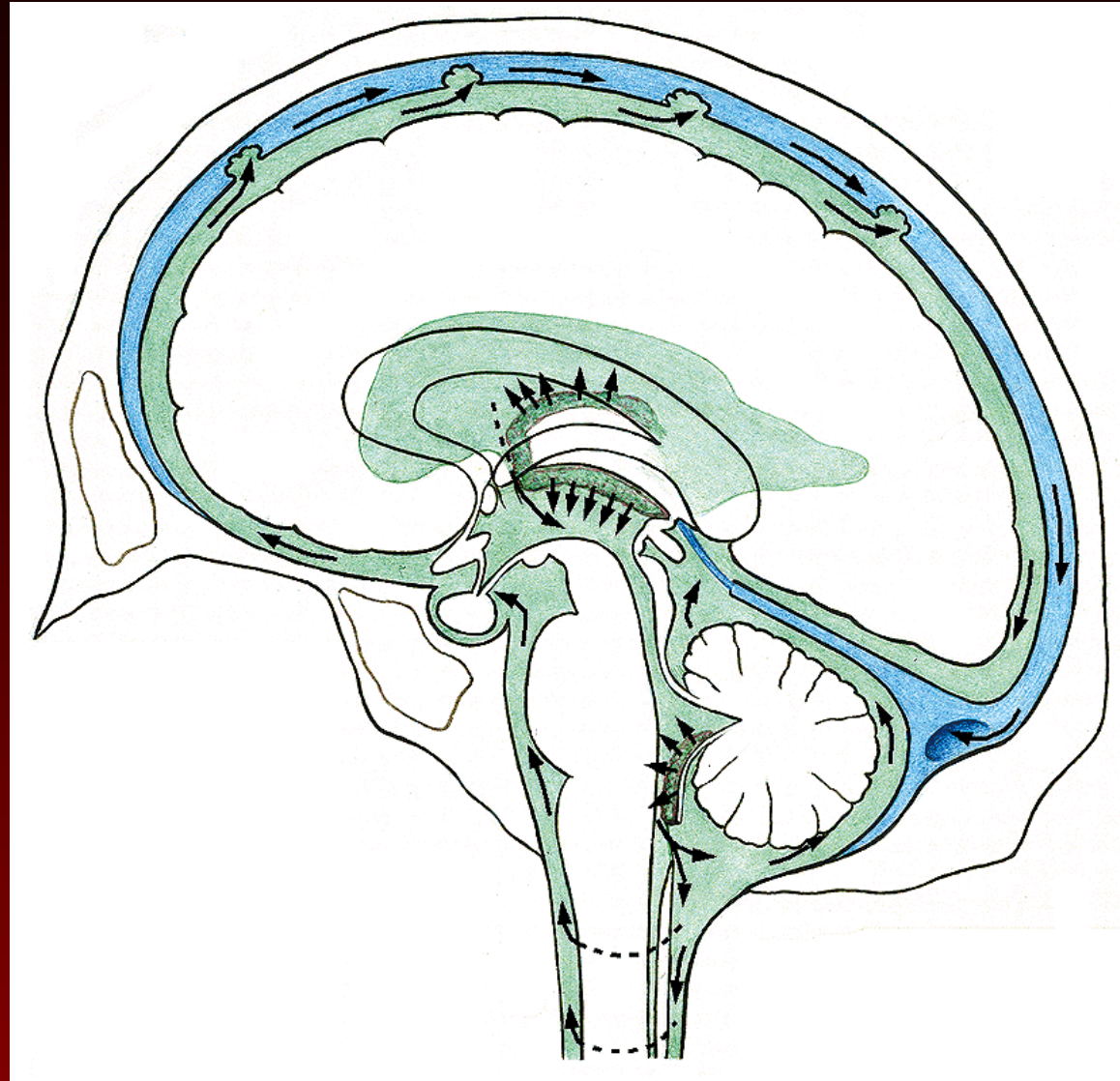
# CEREBROSPINAL FLUID

Production:

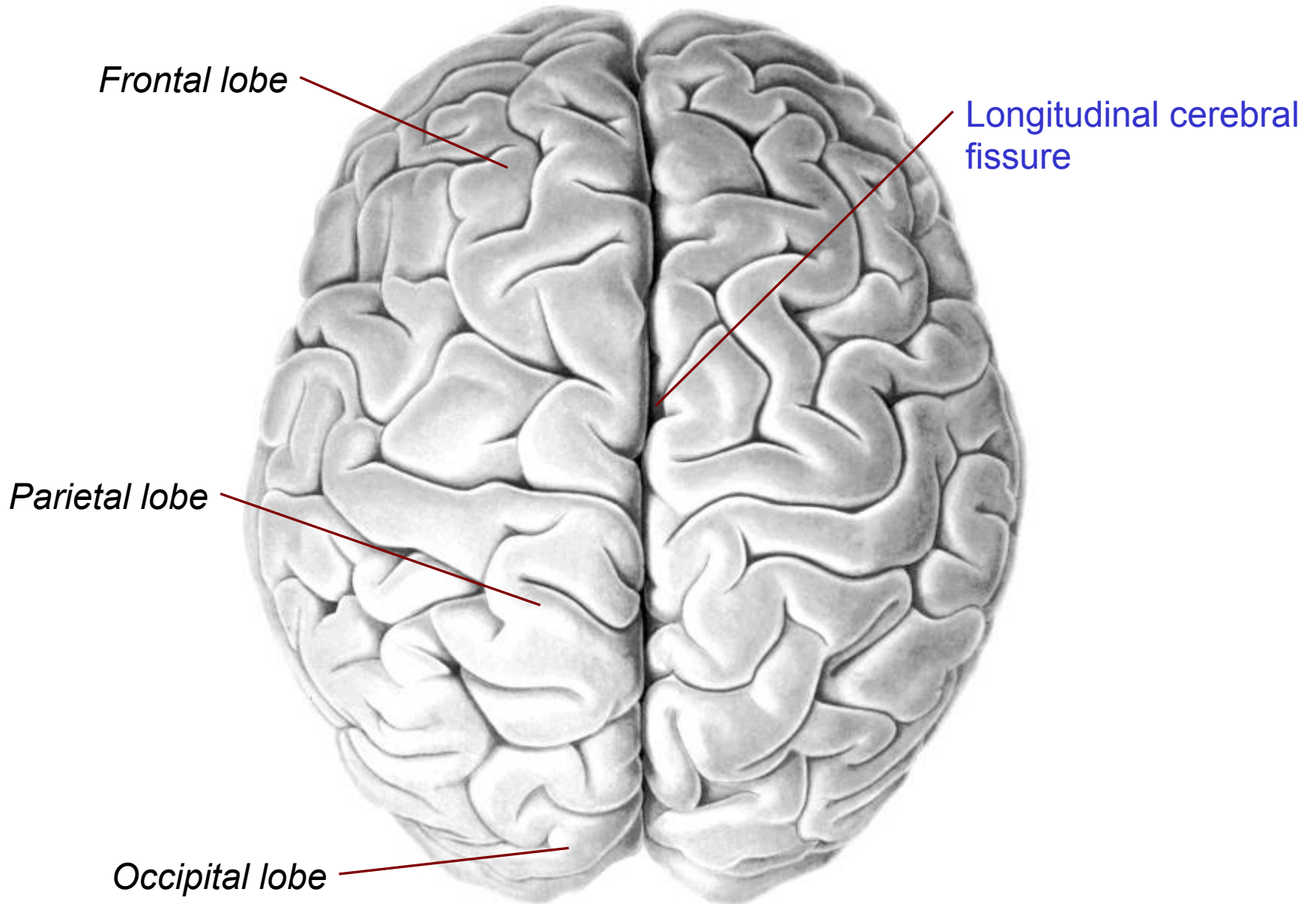
choroid plexus:  
into ventricles

Absorption:

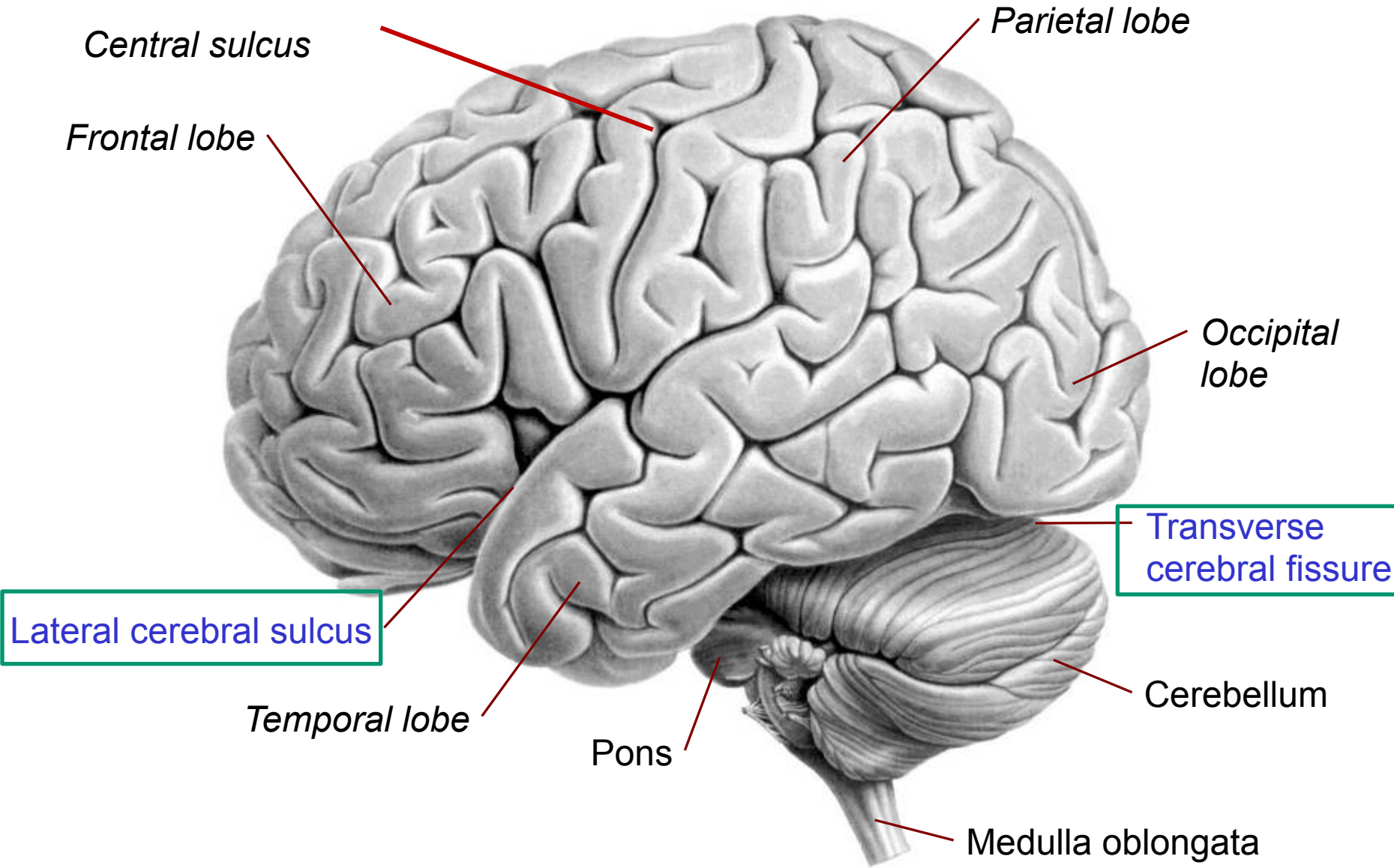
arachnoid villi:  
from subarachnoid space  
into superior sagittal sinus



# BRAIN: Cerebrum SUPERIOR VIEW



# BRAIN: LATERAL VIEW





# BRAIN: MEDIANSAGITTAL CUT

Longitudinal cerebral fissure

**Corpus callosum**

*Frontal lobe*

*Temporal lobe*

Diencephalon (thalamus, hypothalamus, hypophysis)

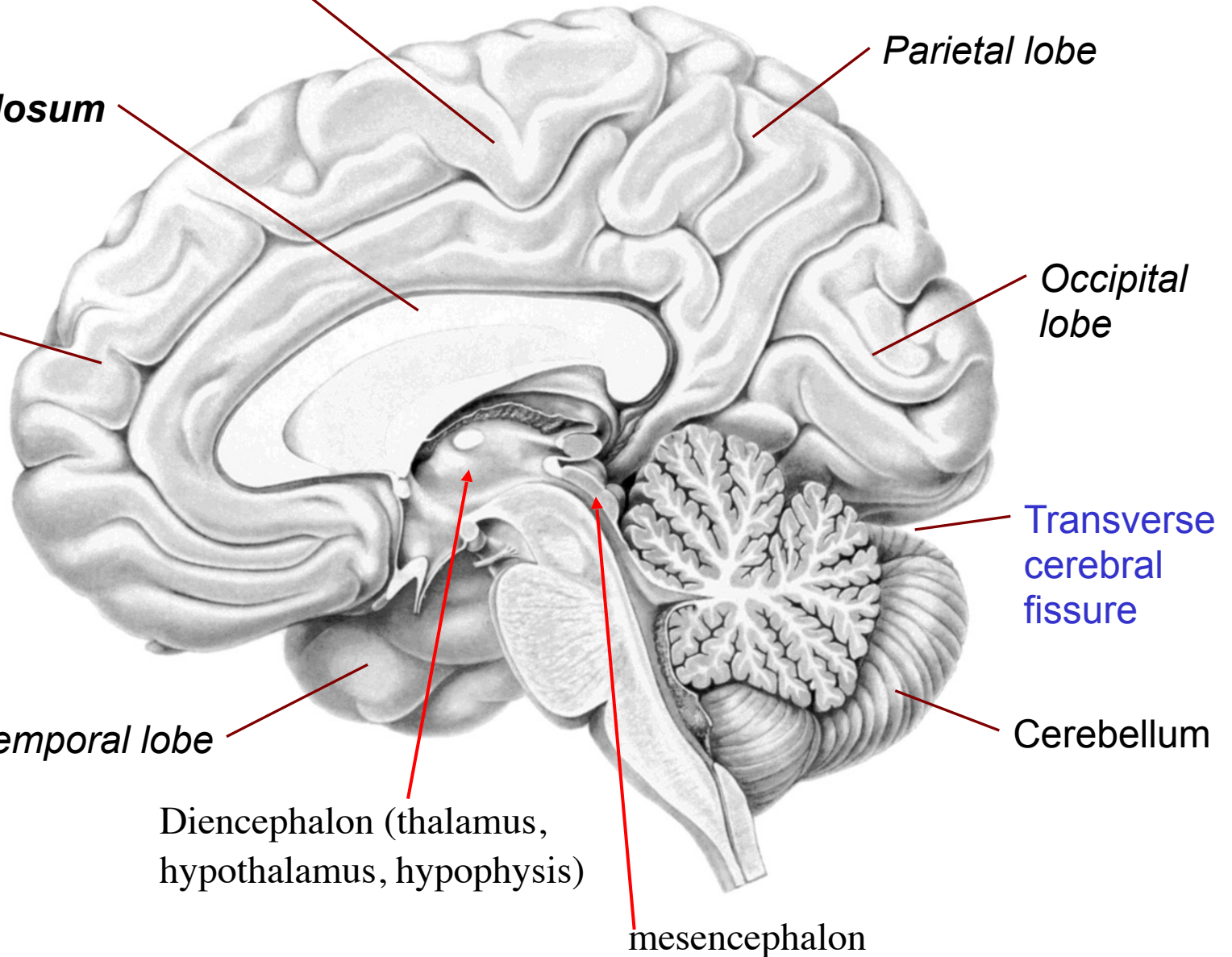
mesencephalon

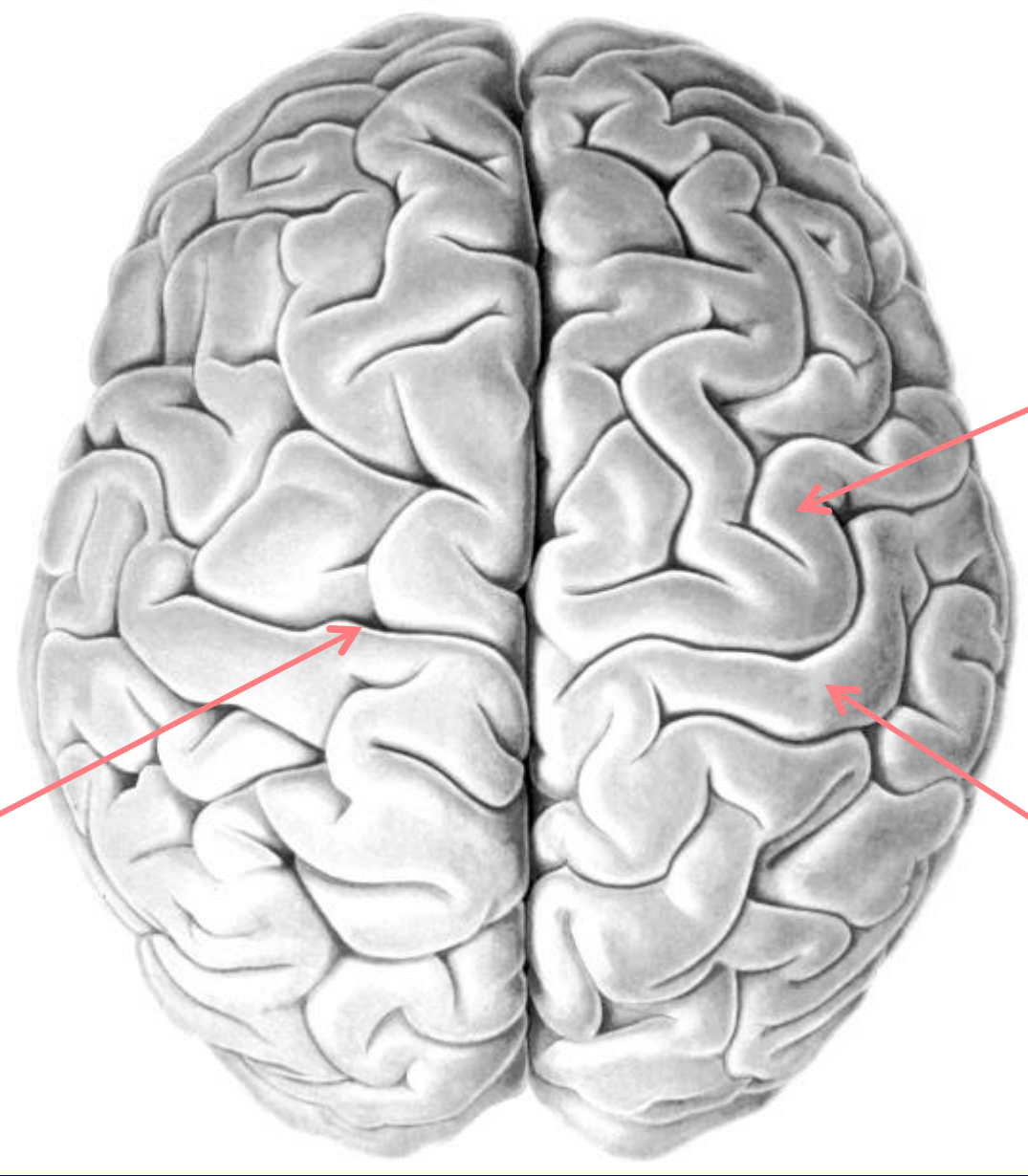
*Parietal lobe*

*Occipital lobe*

Transverse cerebral fissure

Cerebellum

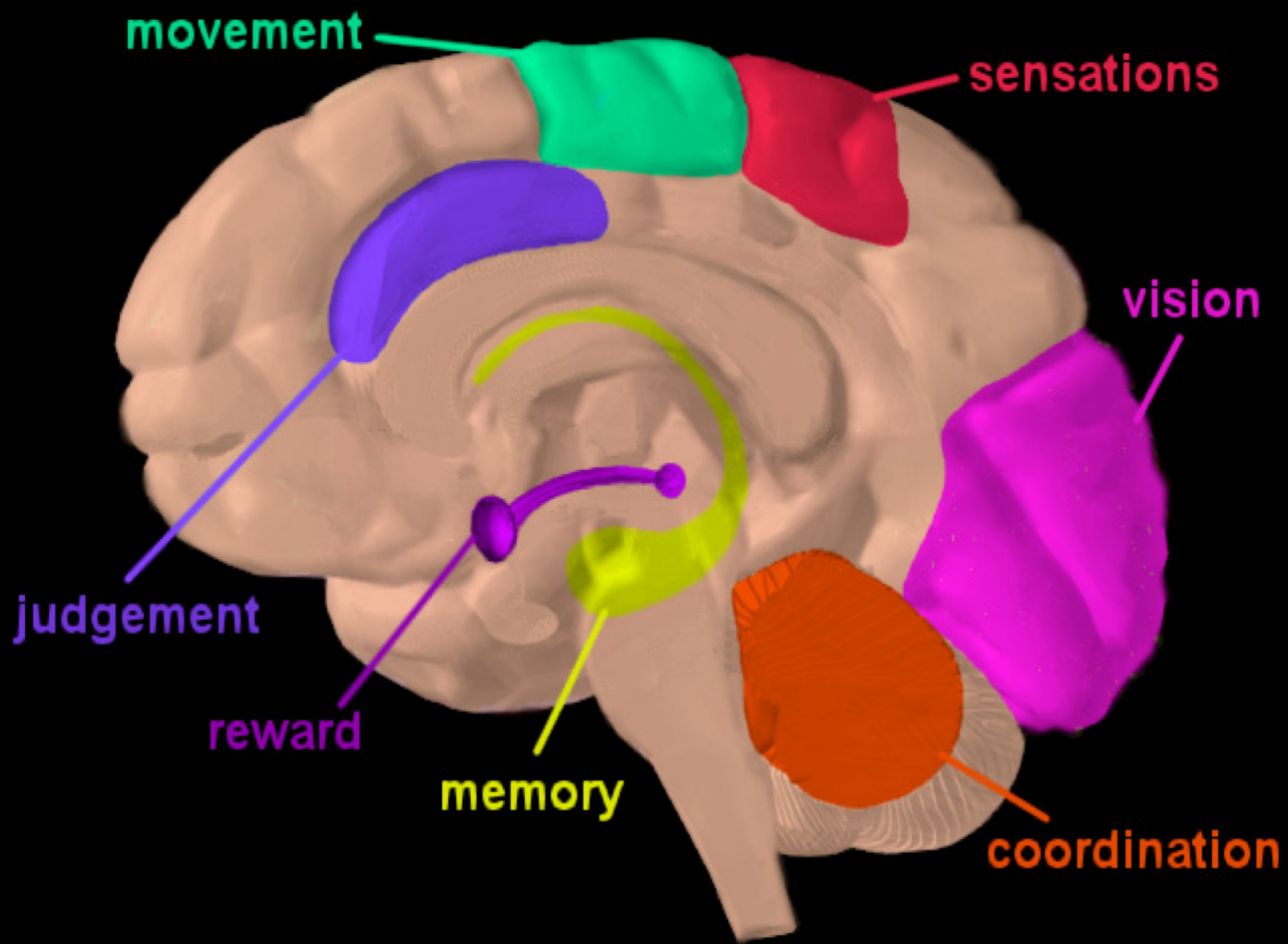




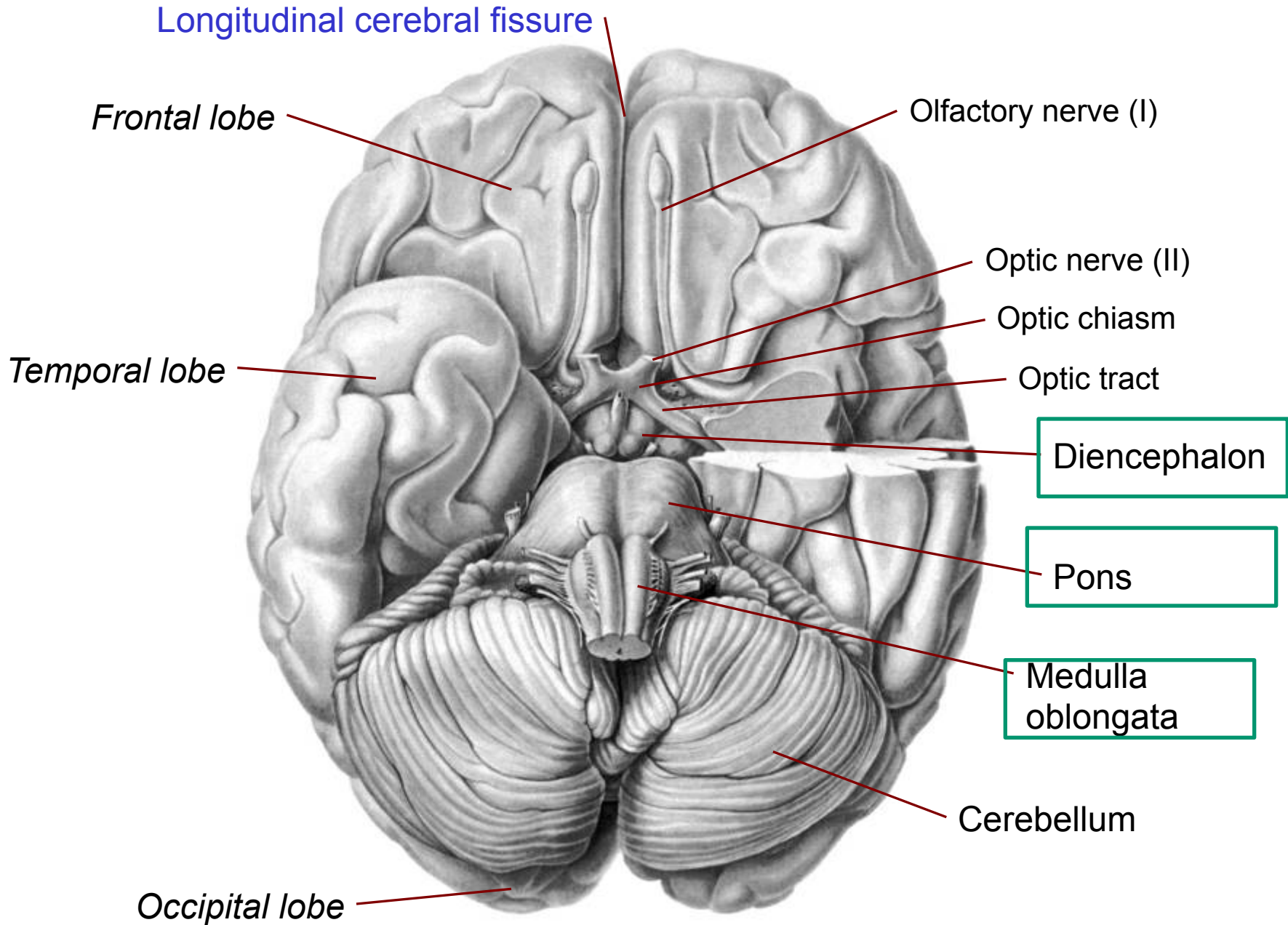
central sulcus

precentral gyrus

postcentral gyrus



# BRAIN: INFERIOR VIEW

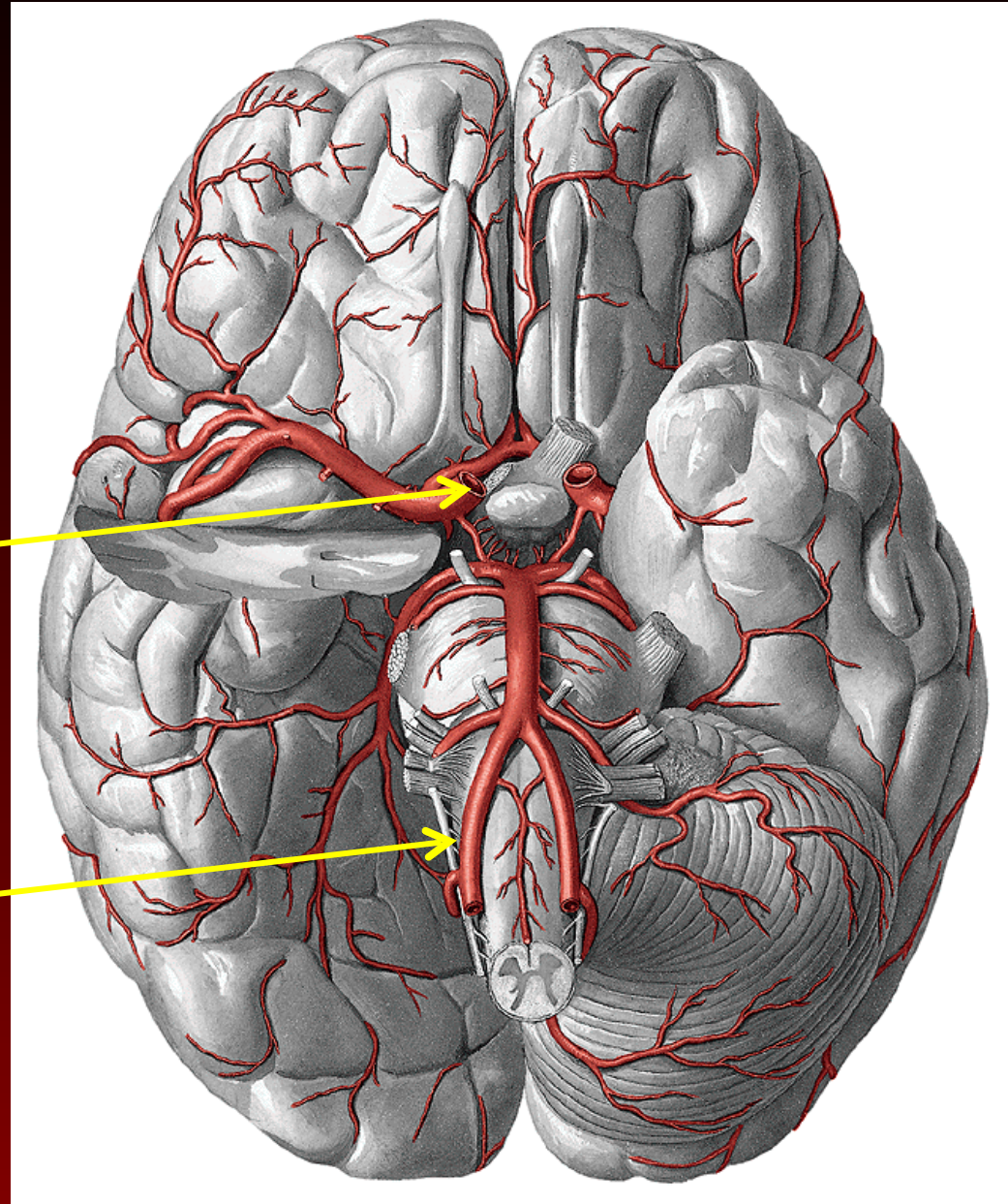


# BLOOD SUPPLY: ARTERIES

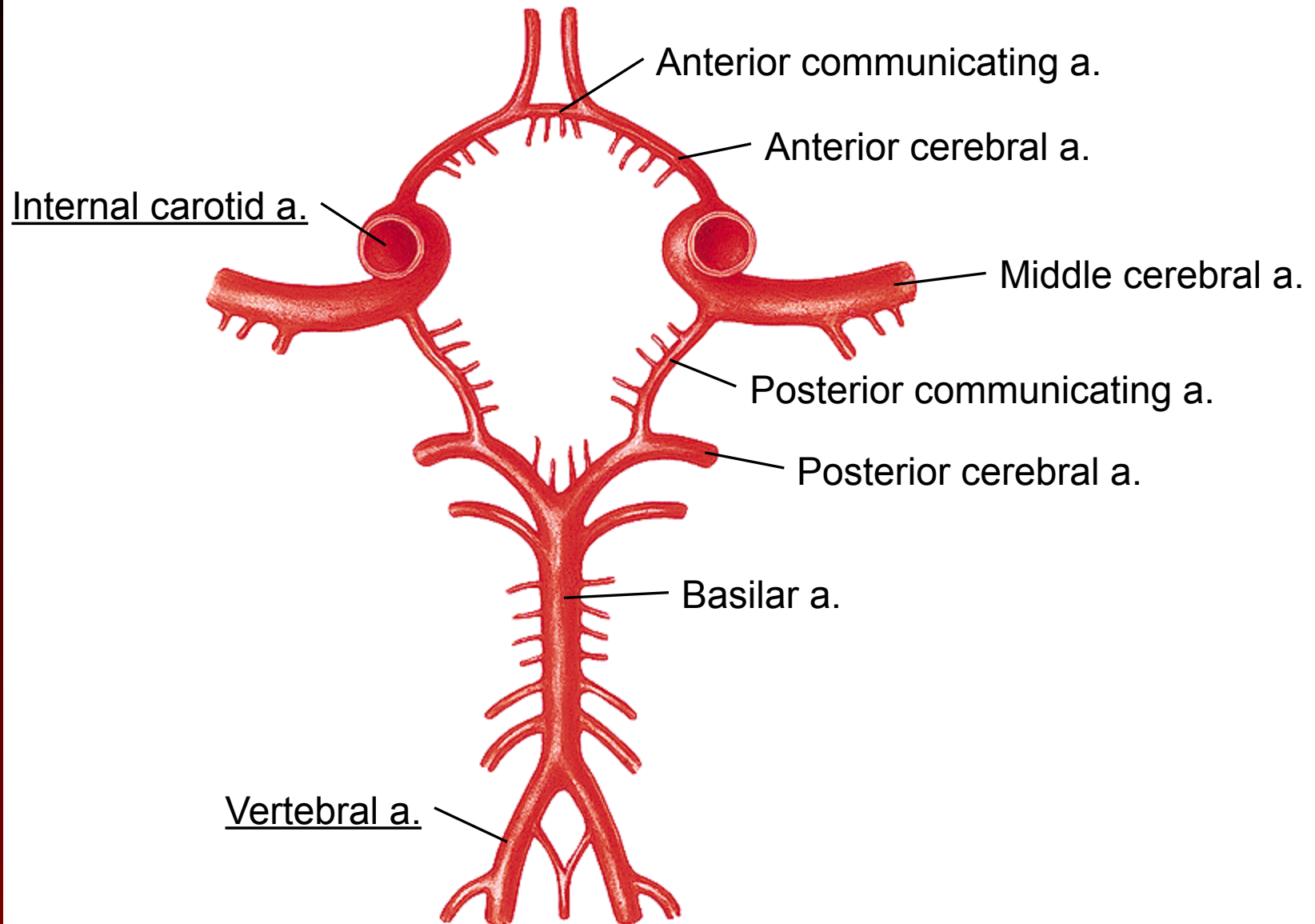
Arterial supply:  
Vertebral artery  
Internal carotid artery

internal carotid artery

vertebral artery

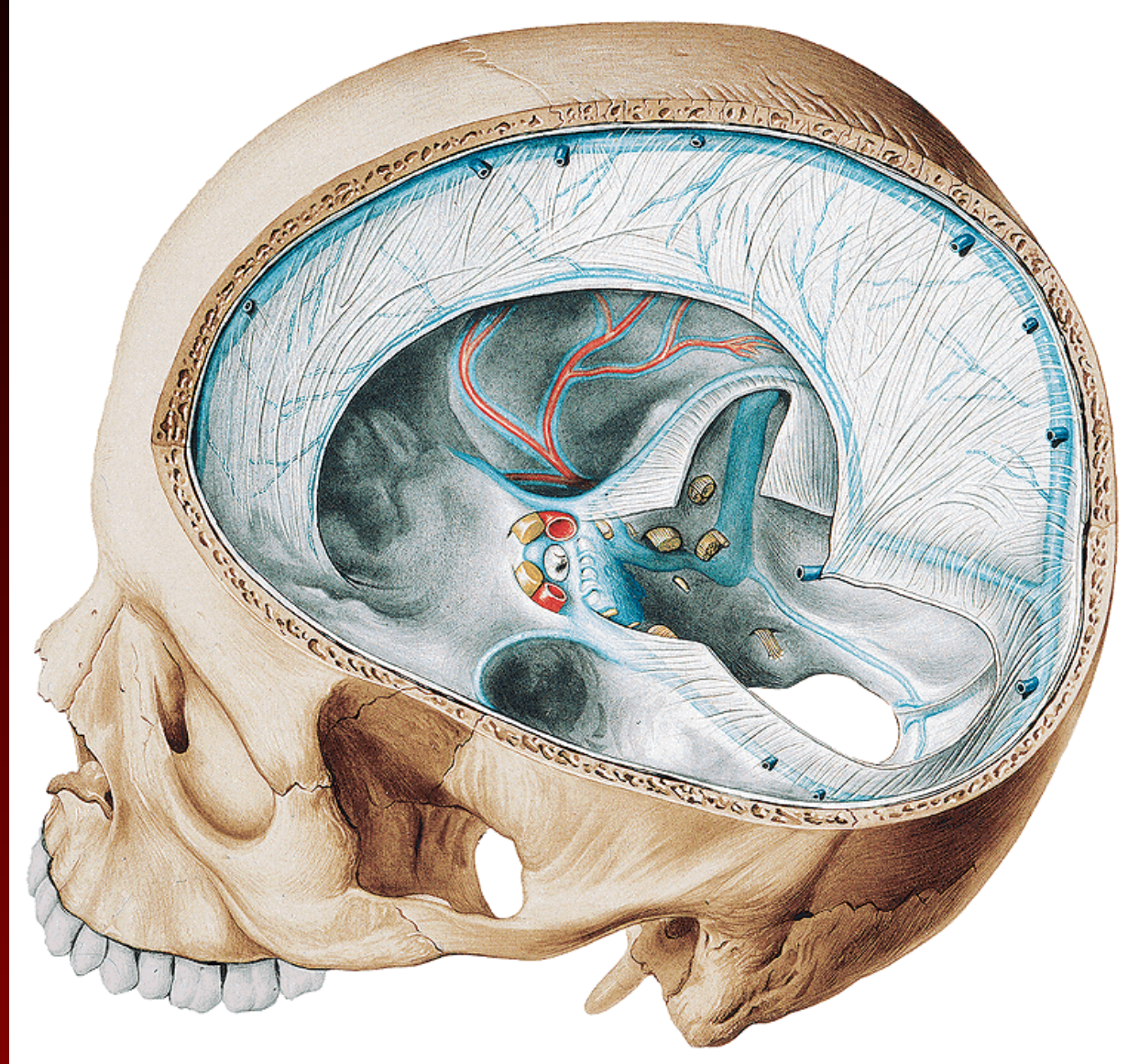


# CIRCLE OF WILLISI

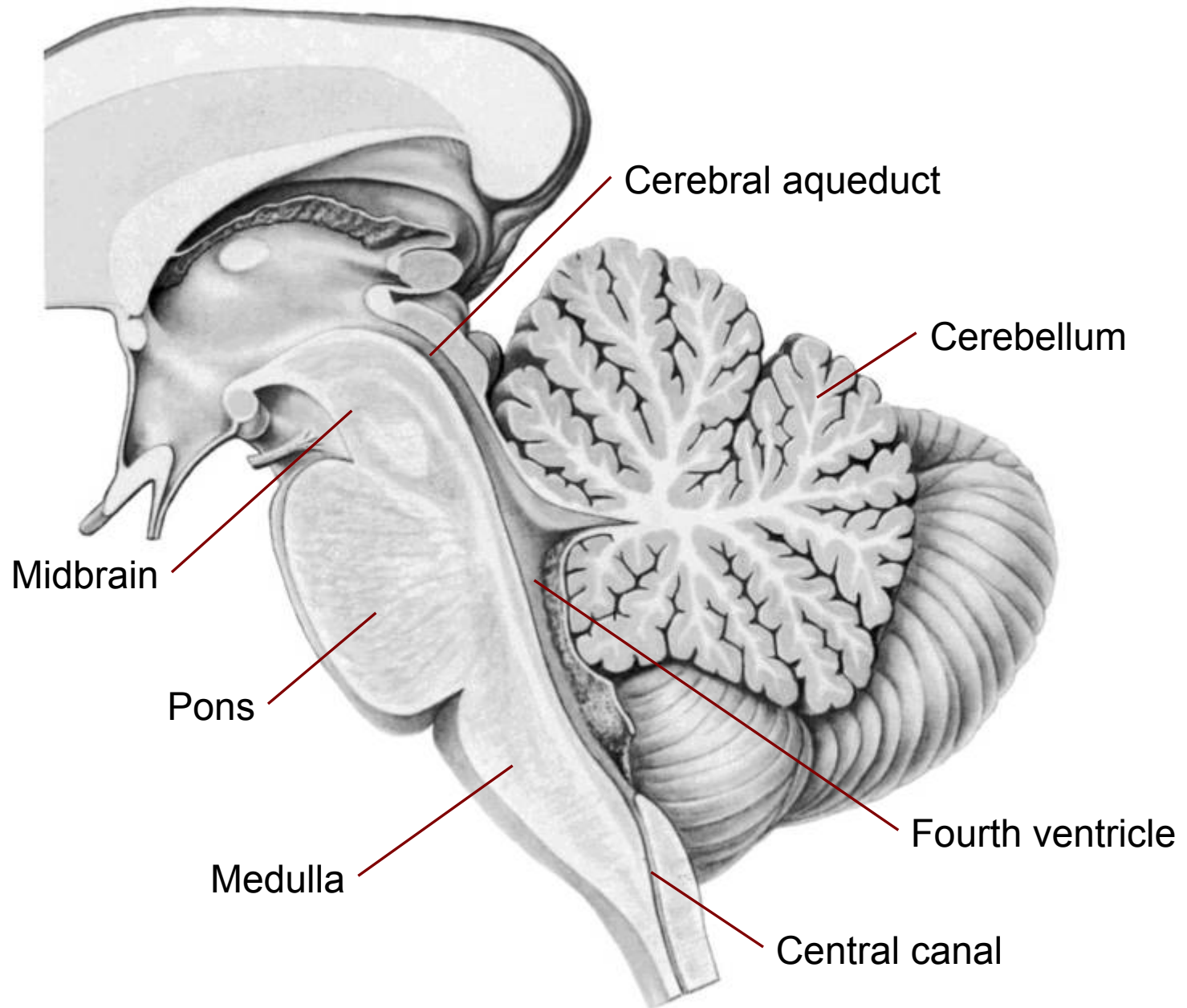


# BLOOD SUPPLY: VEINS

Venous drainage:  
Internal jugular vein:  
Sinuses  
Cerebral veins

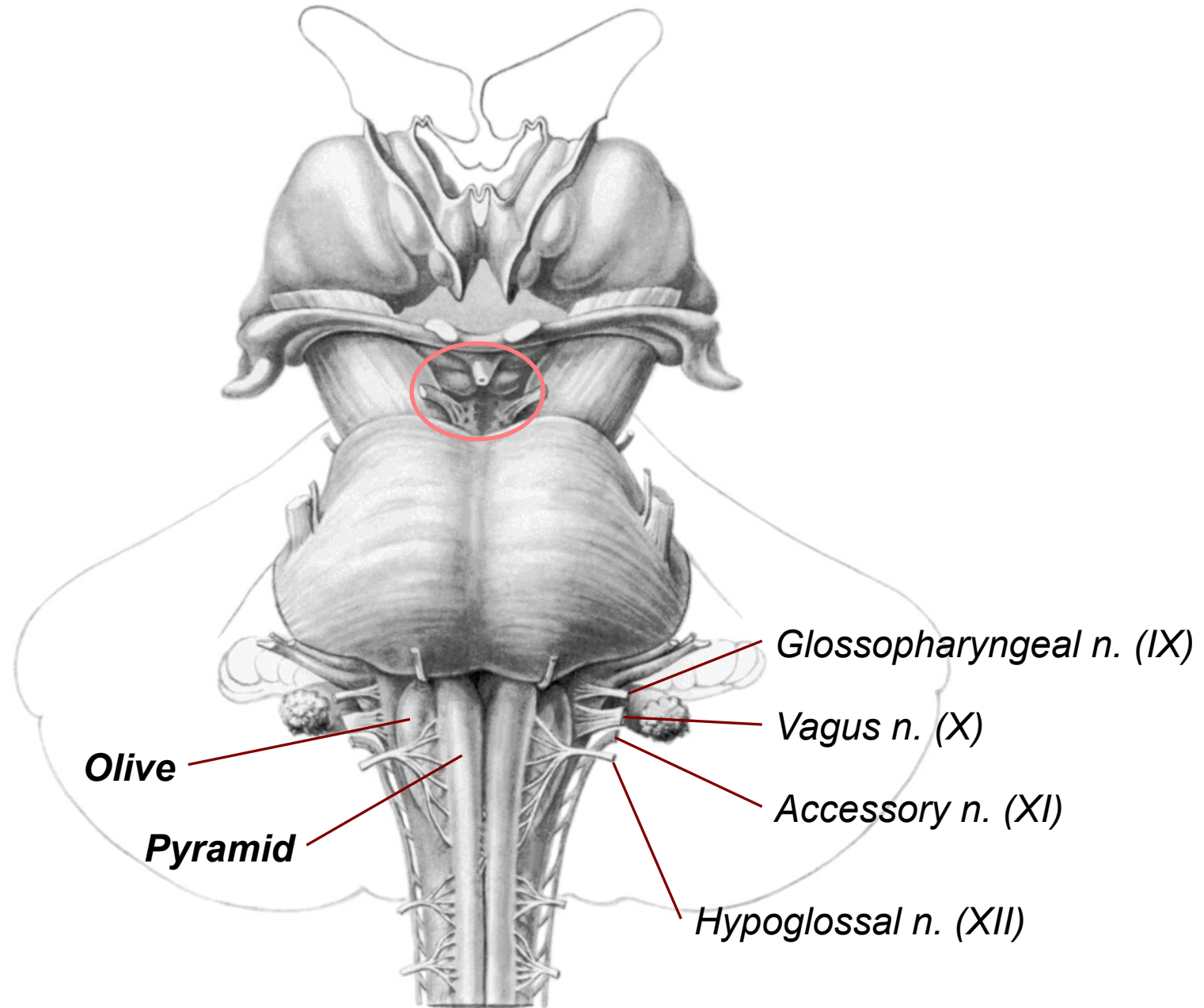


# BRAIN STEM





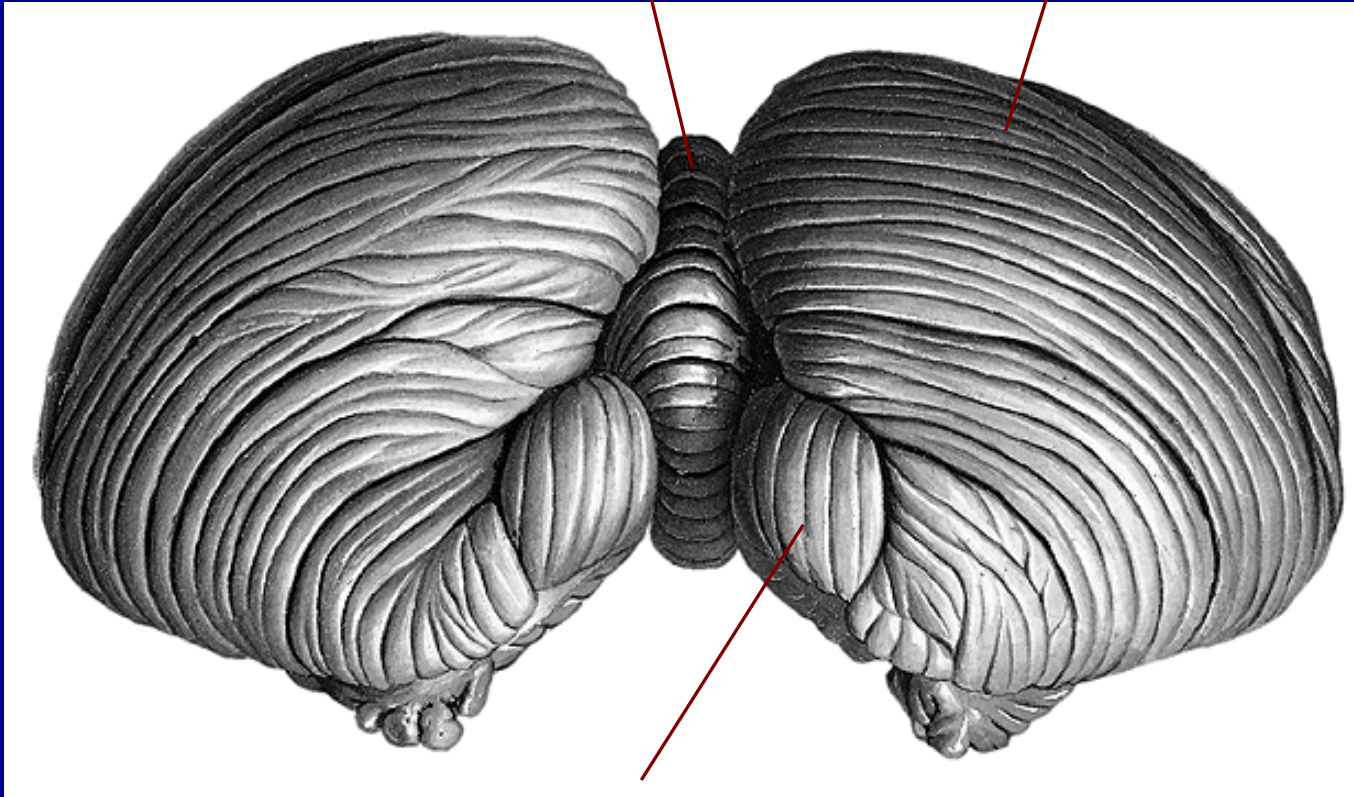
# BRAIN STEM: MEDULLA



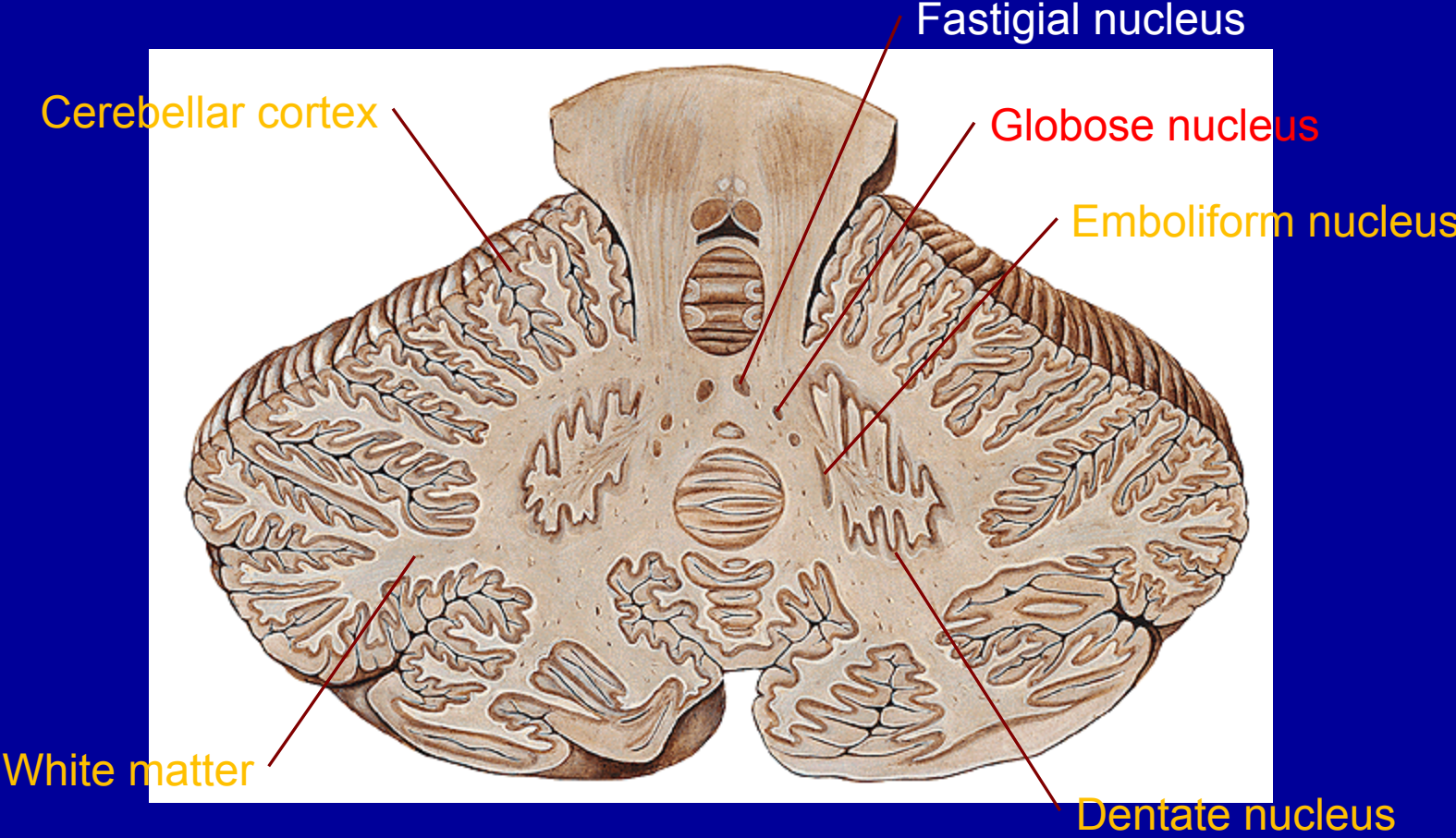
# CEREBELLUM

Vermis

Cerebellar hemisphere



# CEREBELLUM



Cerebellar cortex

Fastigial nucleus

Globose nucleus

Emboliform nucleus

White matter

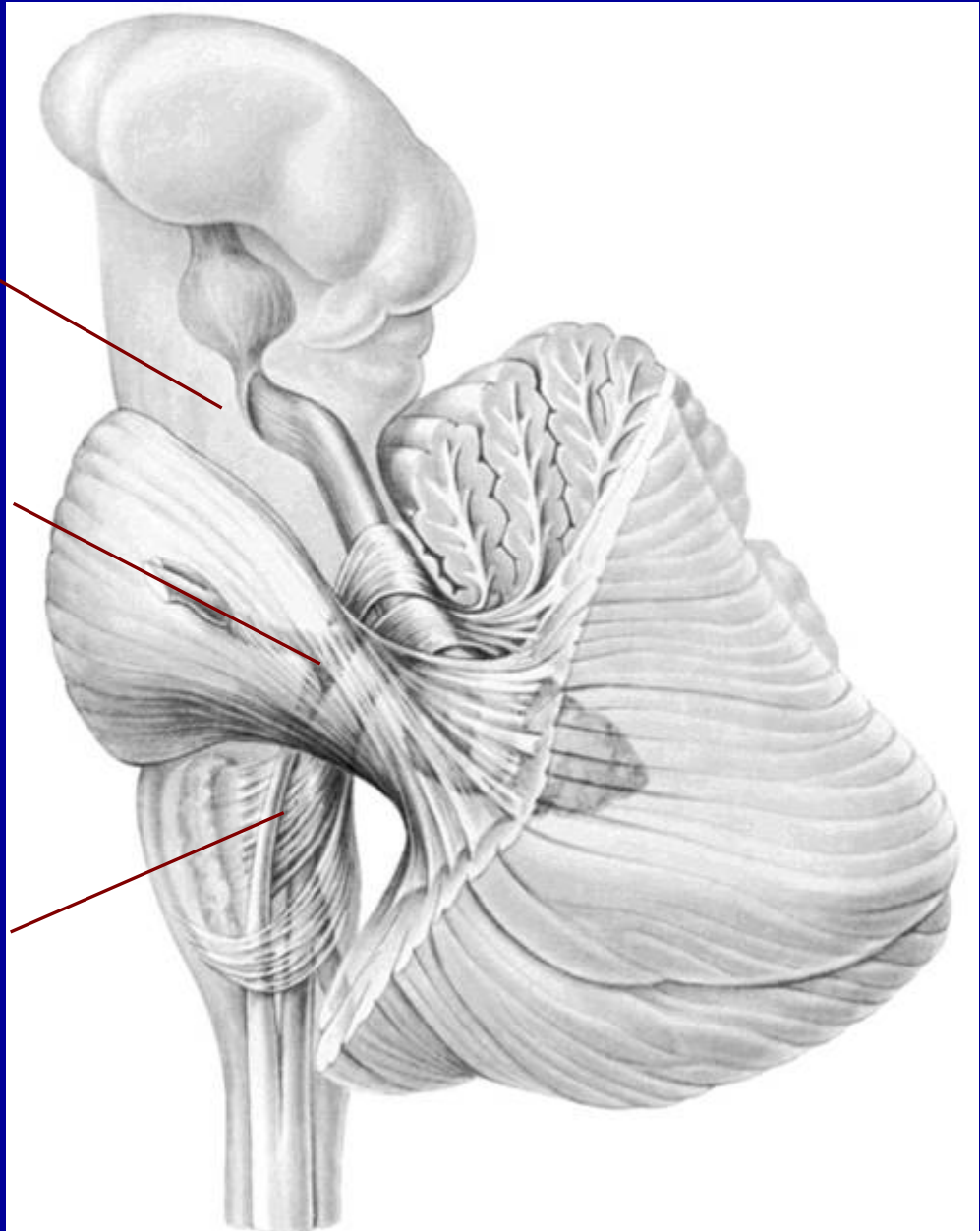
Dentate nucleus

# CEREBELLUM

superior cerebellar peduncle  
midbrain

middle cerebellar peduncle  
pons

inferior cerebellar peduncle  
medulla



# Functional division of the nervous system

## *Somatic*

- voluntary
- starts and stops functions
- segmental

## *Autonomic*

- involuntary
- *regulates* the functions (slow down-speed up)
- network

*sympathetic*  
*thora-columbar*

*parasympathetic*  
*cranio-sacral*

# Autonomic nervous system: efferent part

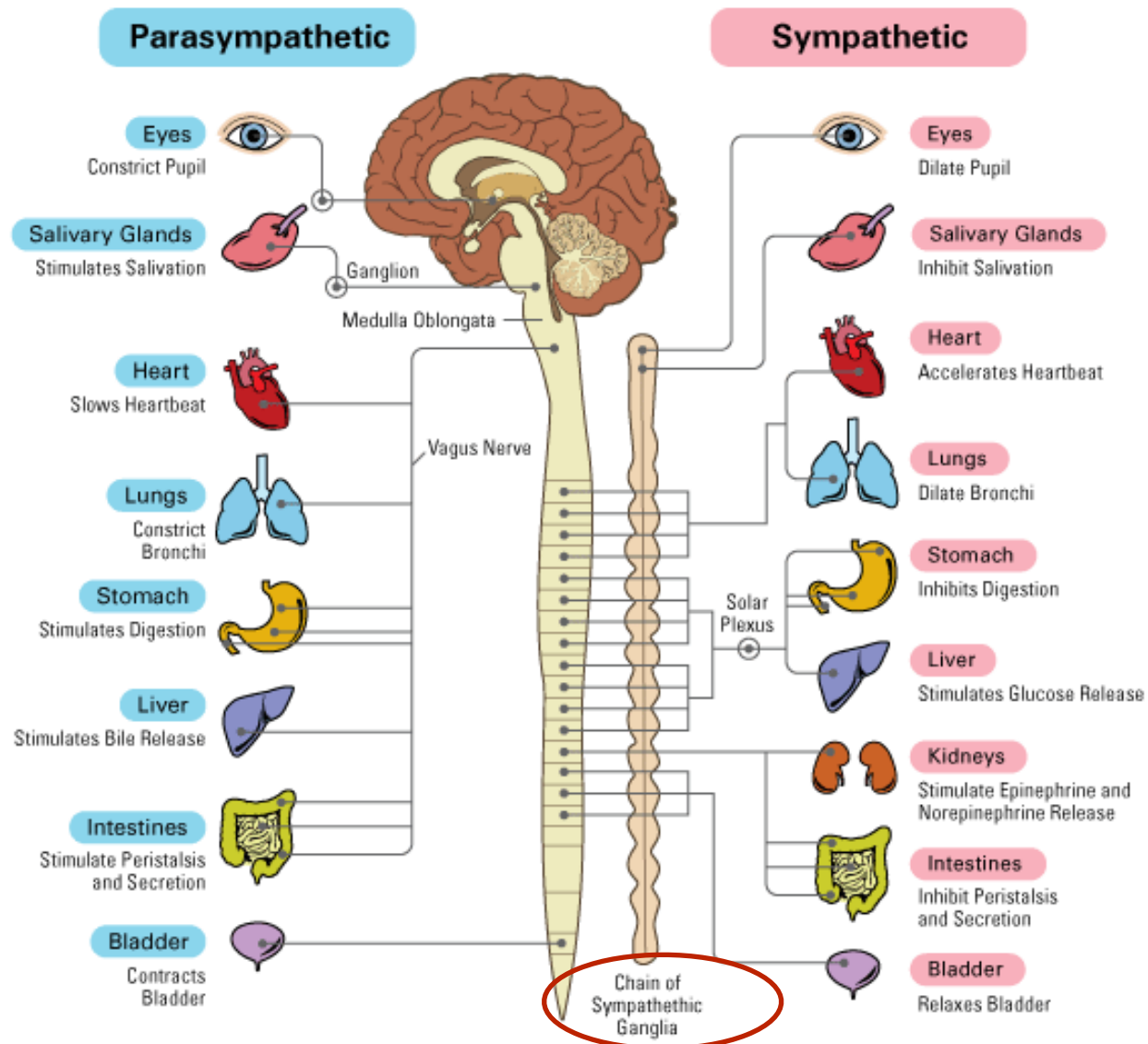
## *Sympathetic*

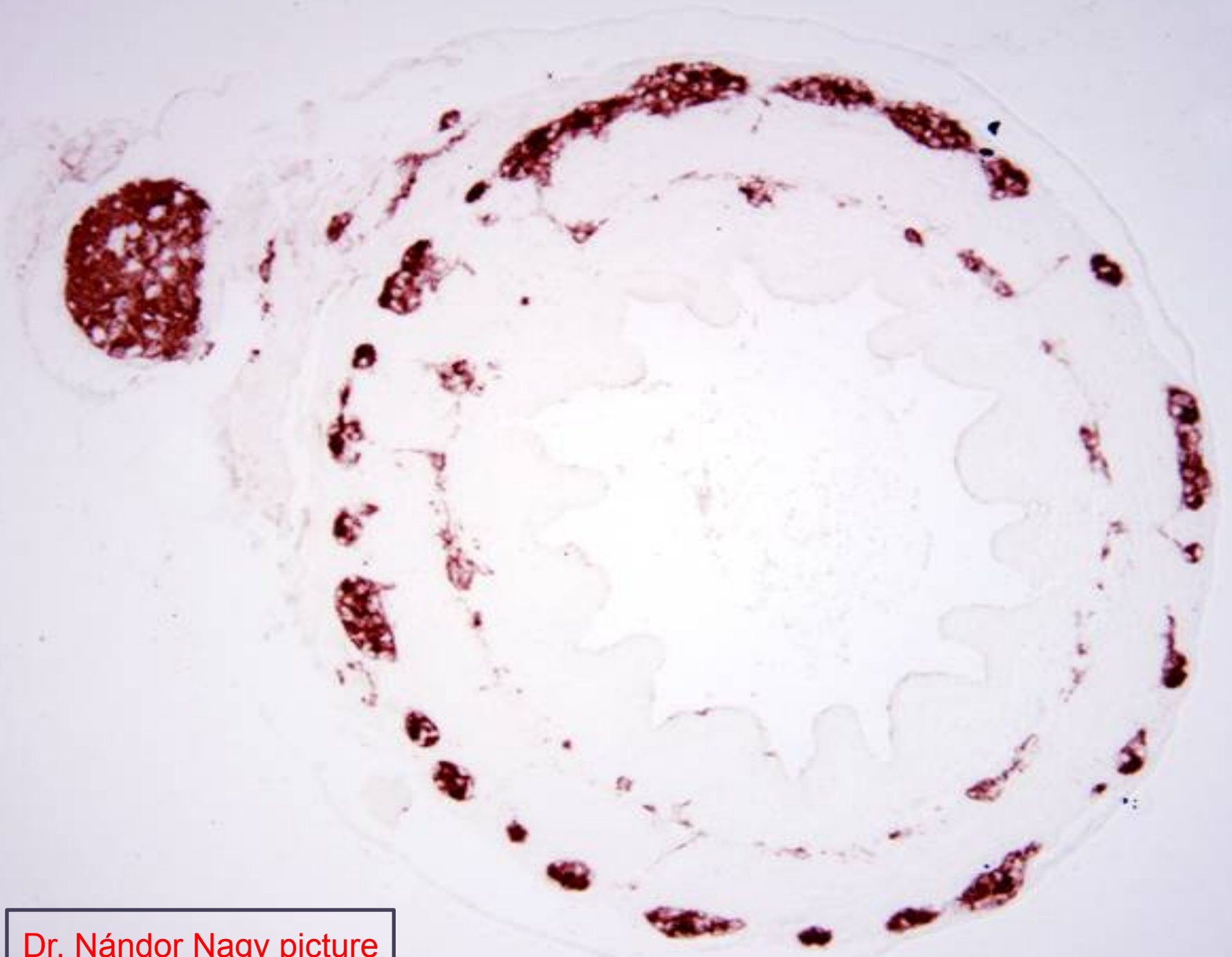
- thoracolumbar segments
- speeds up the functions (except for digestive system)
- empties the stores
- adrenalin, noradrenalin (sympatho-adrenal system)
- last longer
- general effect
- short praeganglionic fibers
- longer postganglionic fibers

## *Parasympathetic*

- craniosacral region
- slows down the functions (except for the digestive system)
- filles in the stores
- acetylcholine
- shorter effect
- local effect
- longer praeganglionic fibers
- shorter postganglionic fibers

# Schema Explaining How Parasympathetic and Sympathetic Nervous Systems Regulate Functioning Organs





Dr. Nándor Nagy picture



# References

Lecture and pictures of Dr. Nandor Nagy  
Sobotta atlas  
Wikipedia