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Ecological, Economic and Social Sustainability

Istanbul Gelisim University

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NEUROANATOMY

4th week – Cerebellum

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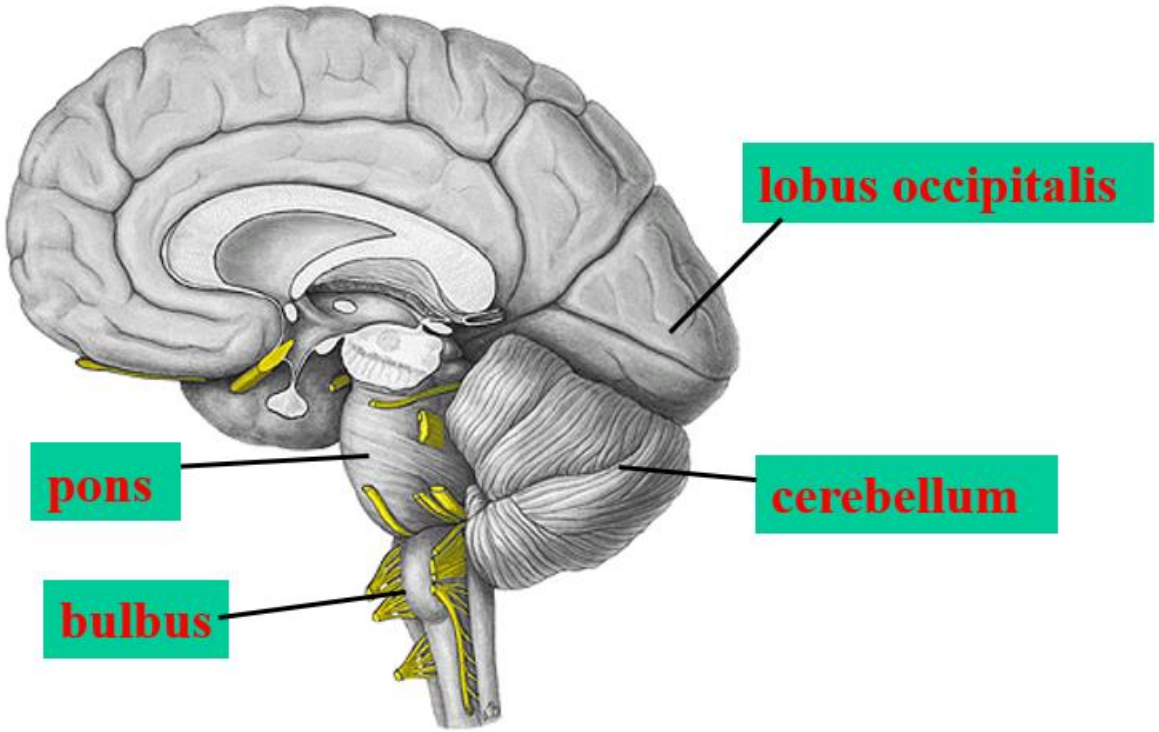
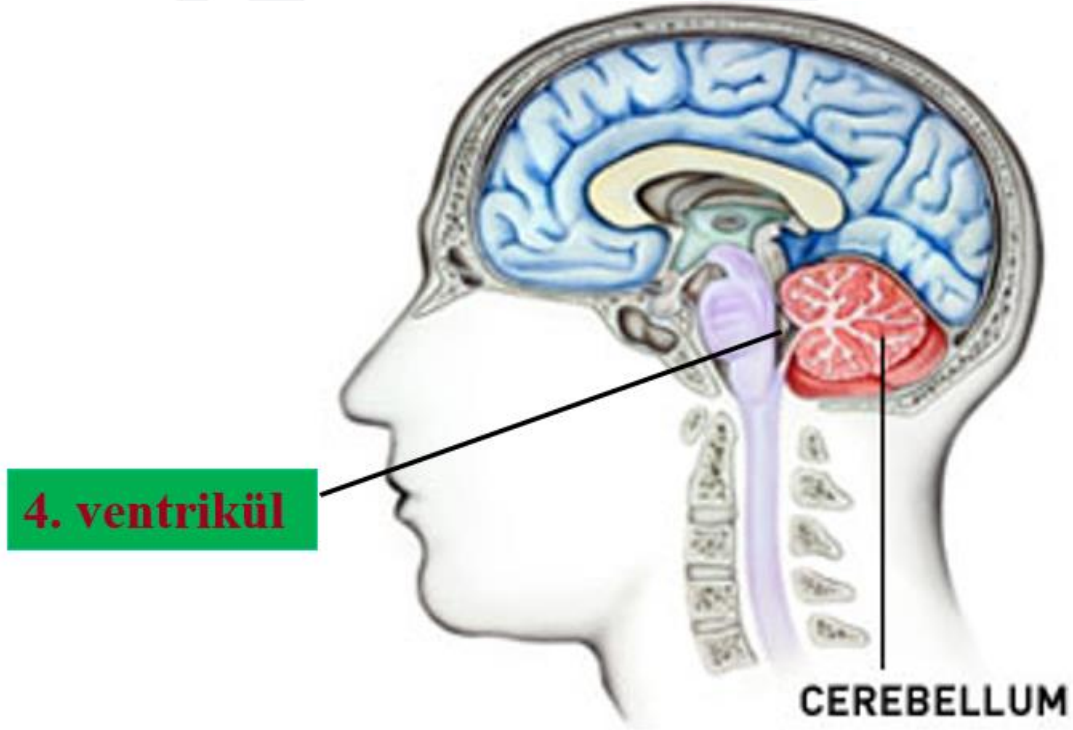
Cerebellum

- Location: It is located posterior to the fossa cranii in the upper-posterior part of the bulbus and pons.



- Between the cerebellum and the bulbus and pons is the 4th ventricle.
- Weight: It is about 150 g in adults. The ratio of cerebellum to encephalon is 1/10 in adults and 1/20 in children.



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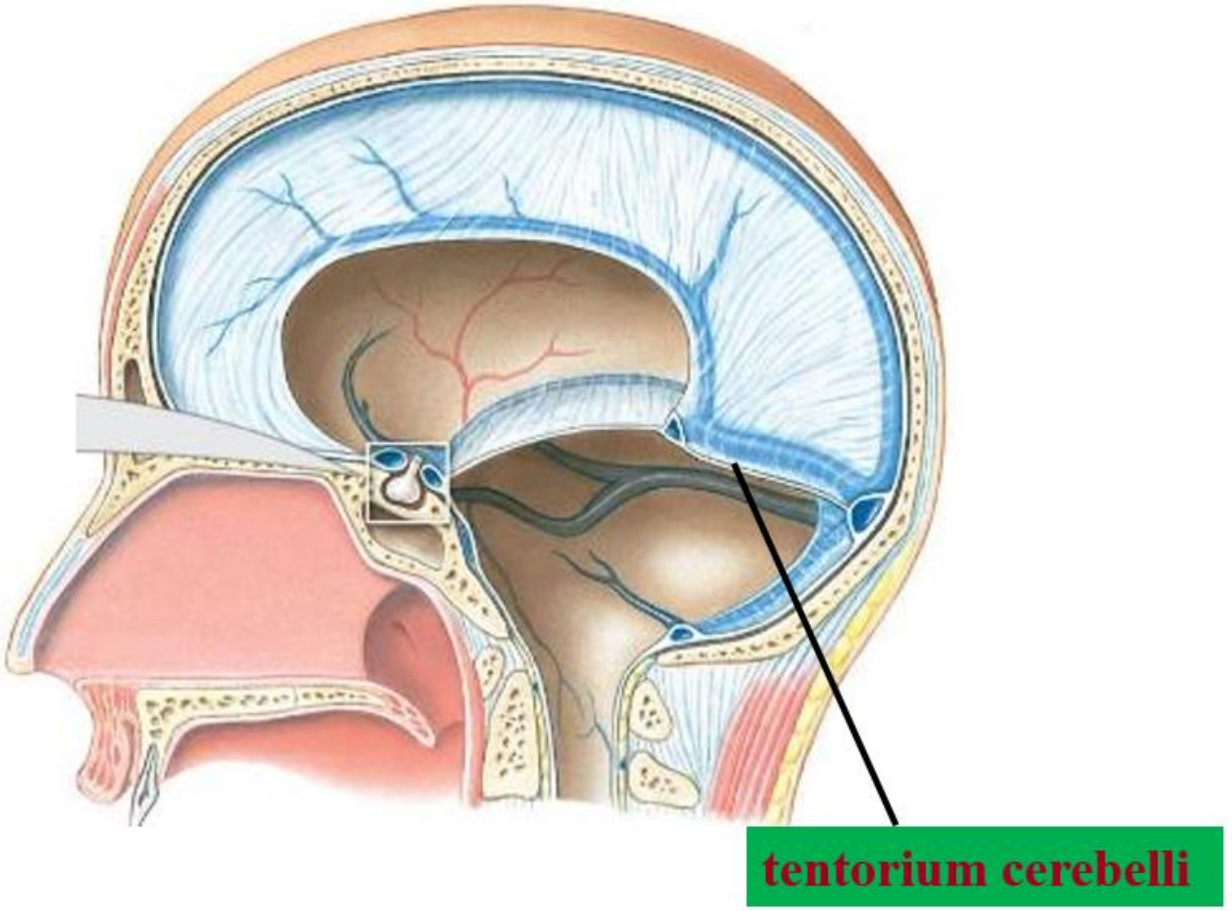
- Between the brain and the cerebellum is the tentorium cerebelli.



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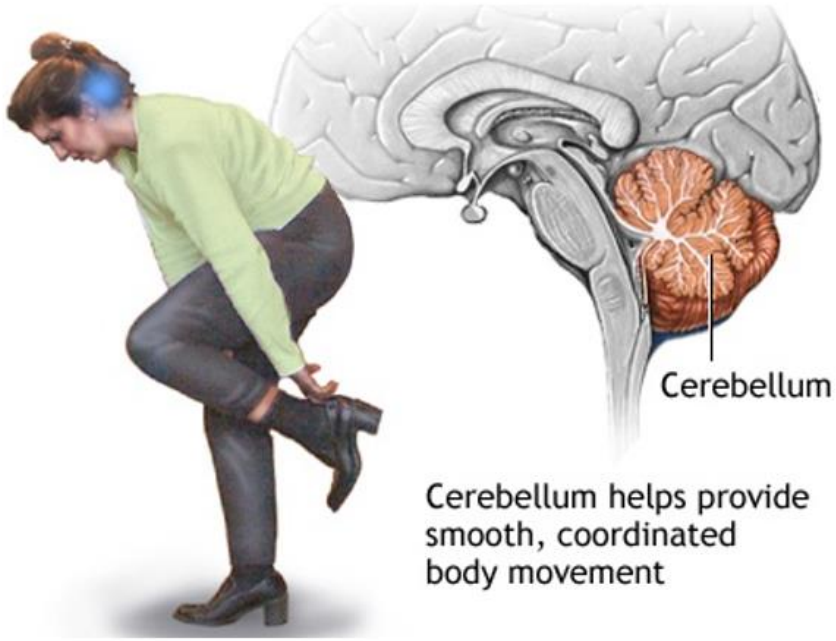
- **Function:** Although the cerebellum receives impulses from many receptors and centers, its main function is; It plays an important role in providing and maintaining our balance by controlling the tone of skeletal muscles and providing coordination between synergist and antagonist muscles.



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- Each hemisphere of the cerebellum controls the skeletal muscles on its side.
- During the movement, the synergist muscles are activated together and on time, and the antagonists are relaxed in a controlled way, thus controlling the cooperation of the muscles.
- In this way, it ensures that the movements are carried out in a controlled and regular manner, and thus our balance.

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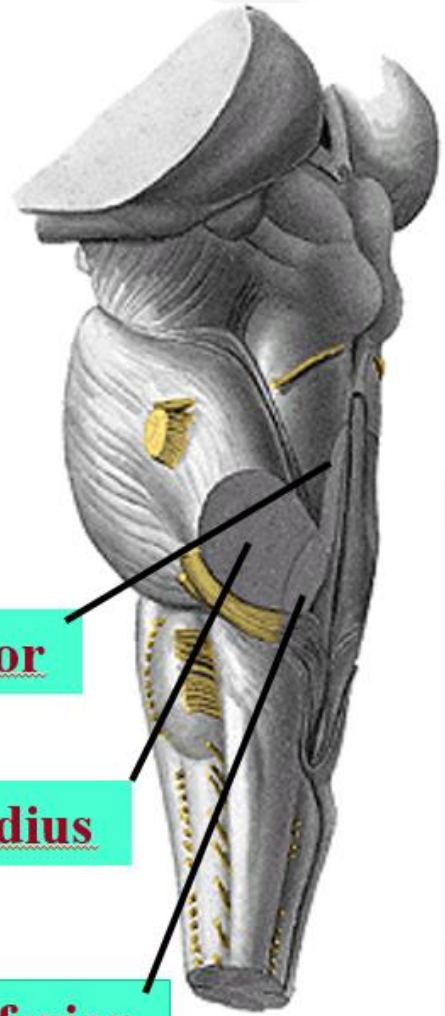
- **Connections of the cerebellum:** Pedunculus cerebellaris inferior connects to bulbus, Pedunculus cerebellaris medius to pons, and Pedunculus cerebellaris superior to mesencephalon.



Pedunculus cerebellaris superior

Pedunculus cerebellaris medius

Pedunculus cerebellaris inferior

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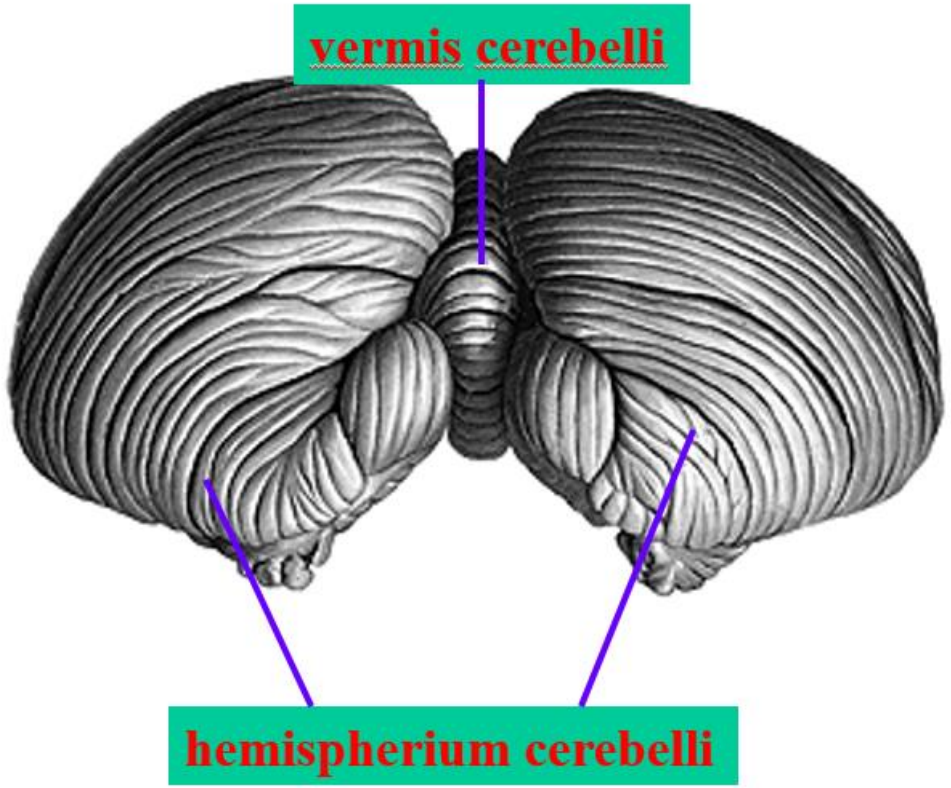
- The cerebellum consists of two lateral lobes, called the hemispherium cerebelli, and the vermis cerebelli, which connects them in the middle.



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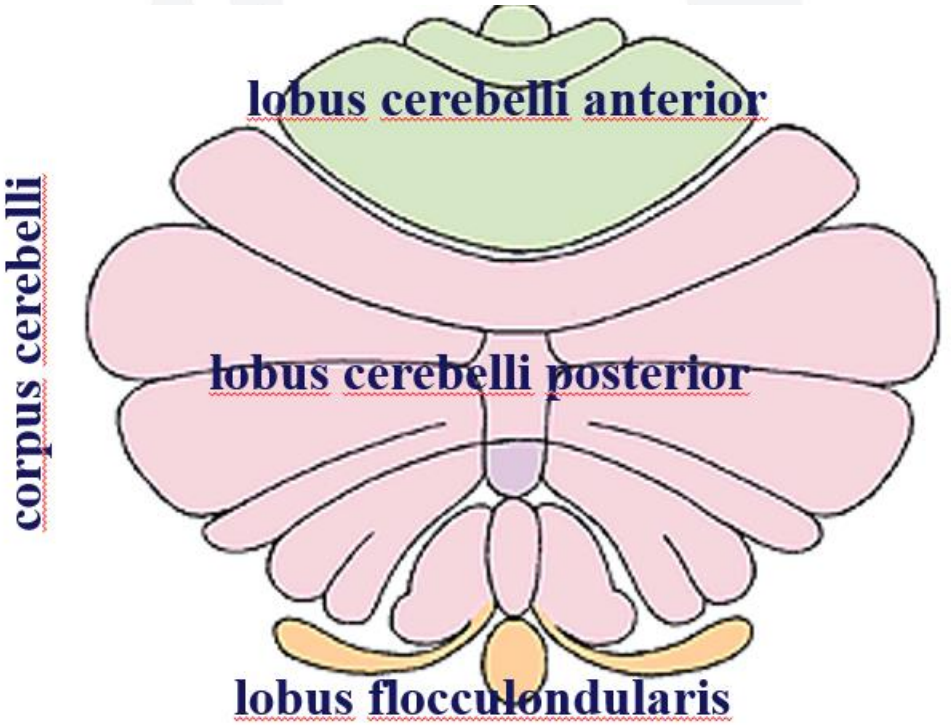
- The cerebellum is divided into three lobes: lobus cerebelli anterior, lobus cerebelli posterior, and lobus flocculondularis. All parts of the cerebellum except the lobus flocconodularis are collectively called the corpus cerebelli. This scale has no functional significance.



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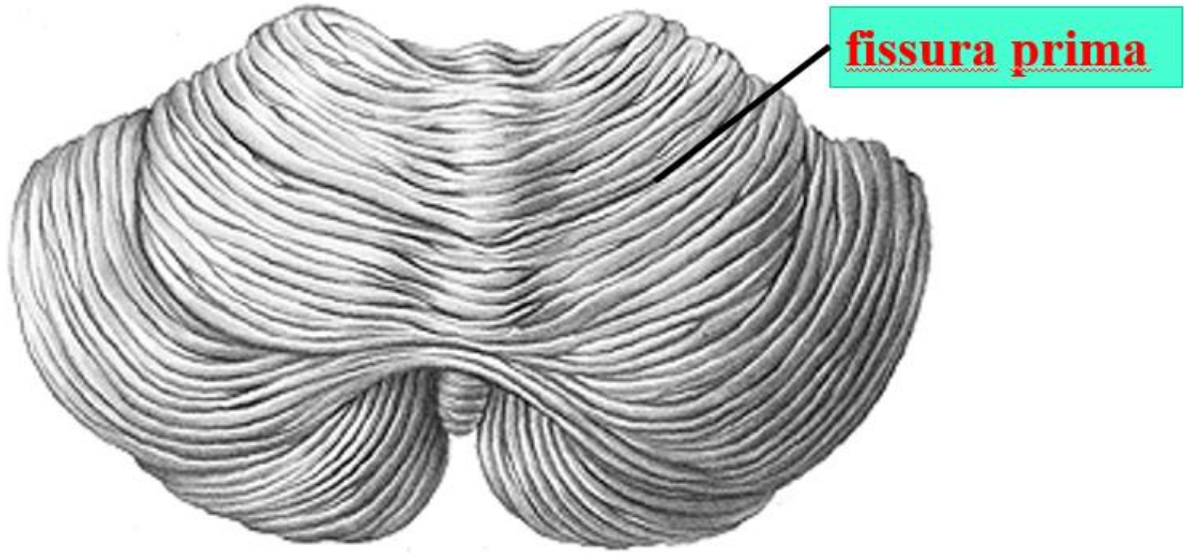
- The corpus cerebelli receives impulses from the spinal cord, nerve trigeminus, and nuclei pontis. Lobus flocculonodularis receives impulses from nuclei vestibularis.
- The lobus anterior is located on the upper-anterior aspect of the cerebellum and can be seen from the upper surface. The cleft between the lobus anterior and lobus posterior is called the **fissura prima**. This groove is in the form of a deep slit resembling the letter V on the upper surface of the cerebellum and extends transversely.



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- Between the lobus posterior and the lobus flocculonodularis, there is the fissura posterolateralis (dorsolateralis).
- The groove that separates the upper and lower surfaces of the cerebellum hemispheres is called fissura horizontalis. This groove is located between the lobulus semilunaris superior and inferior.

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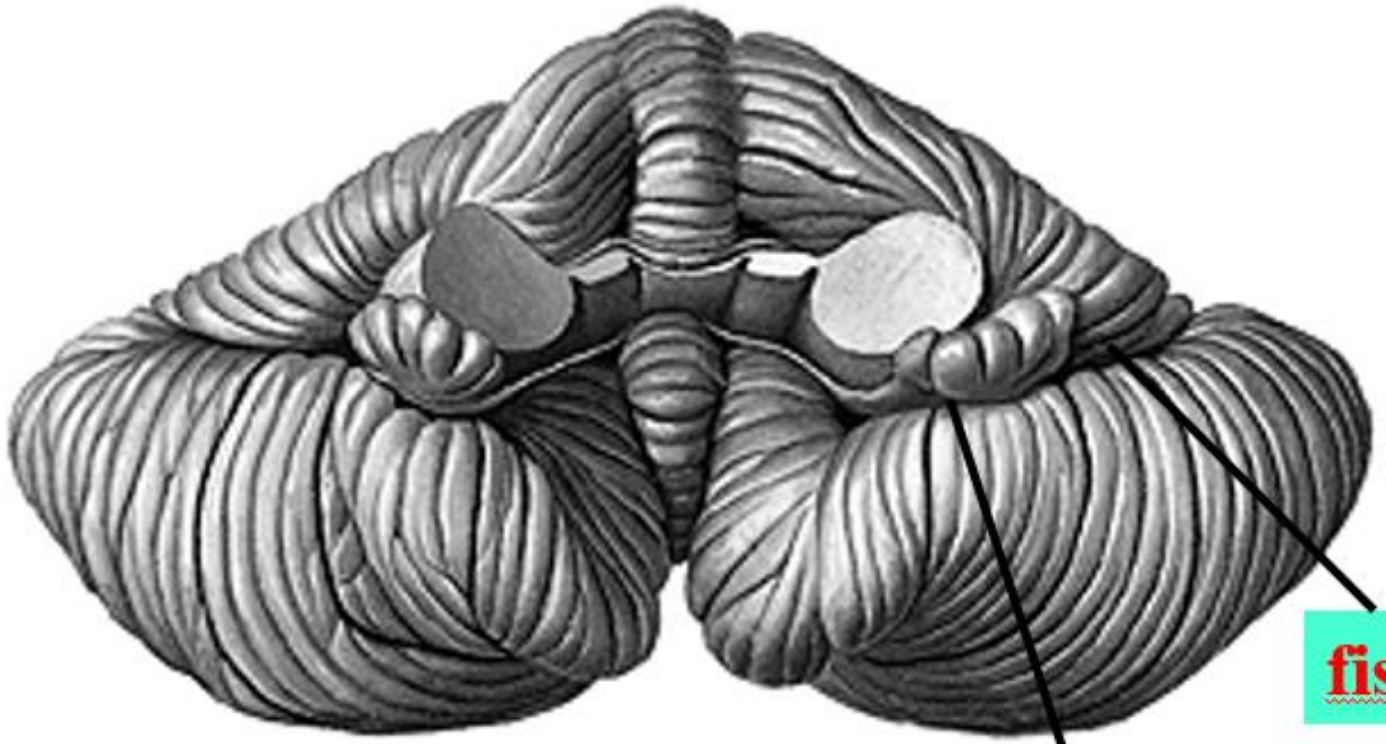
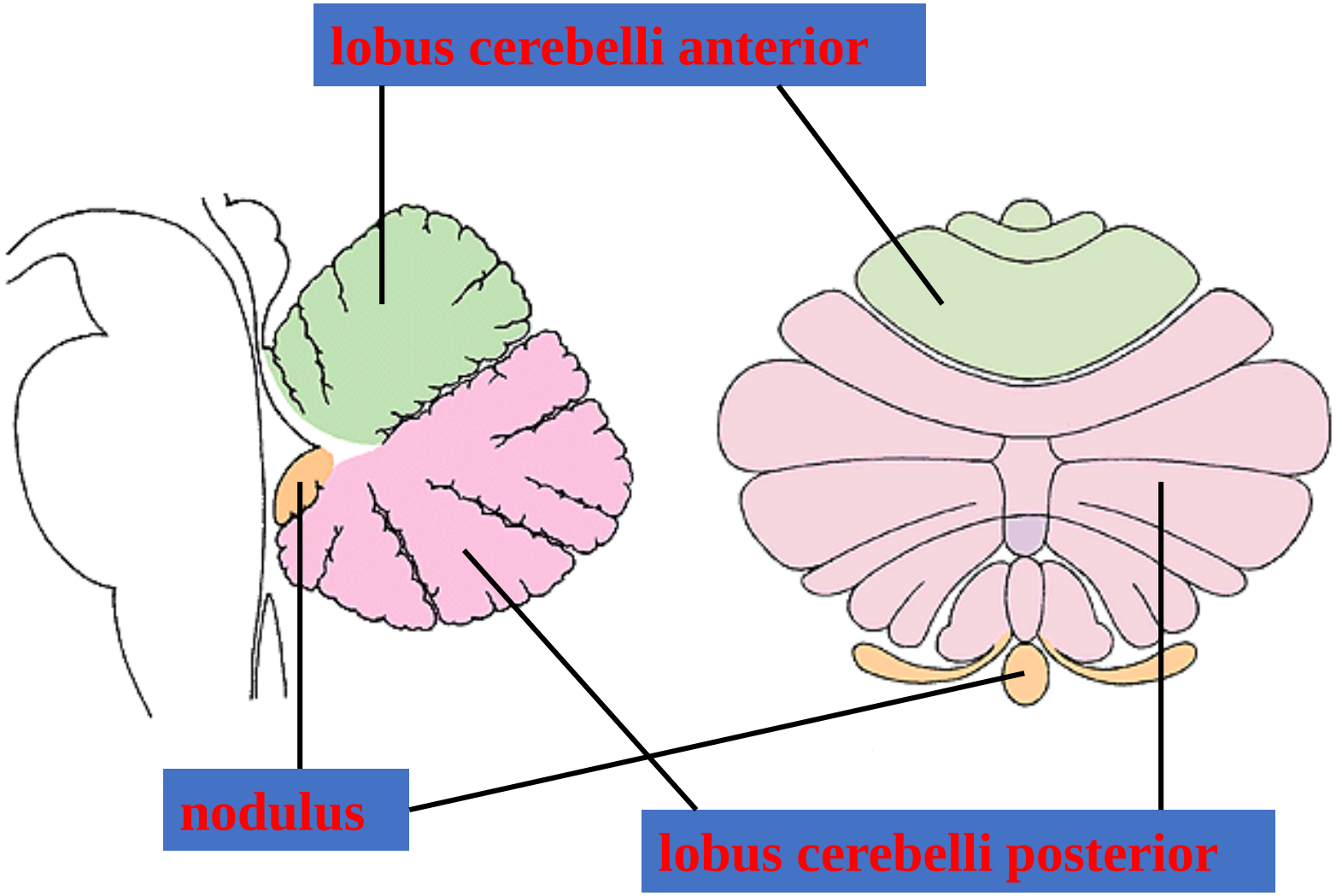
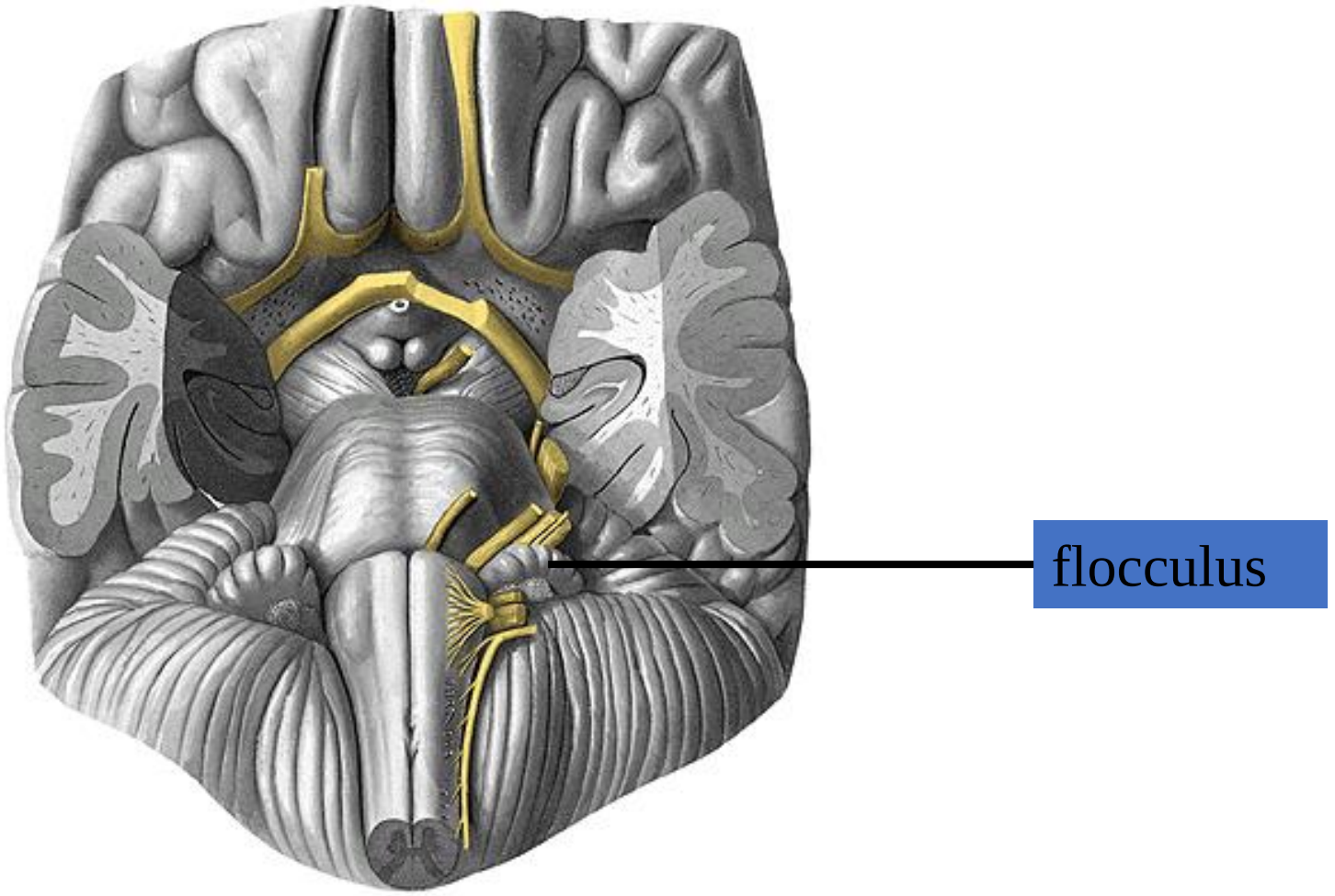


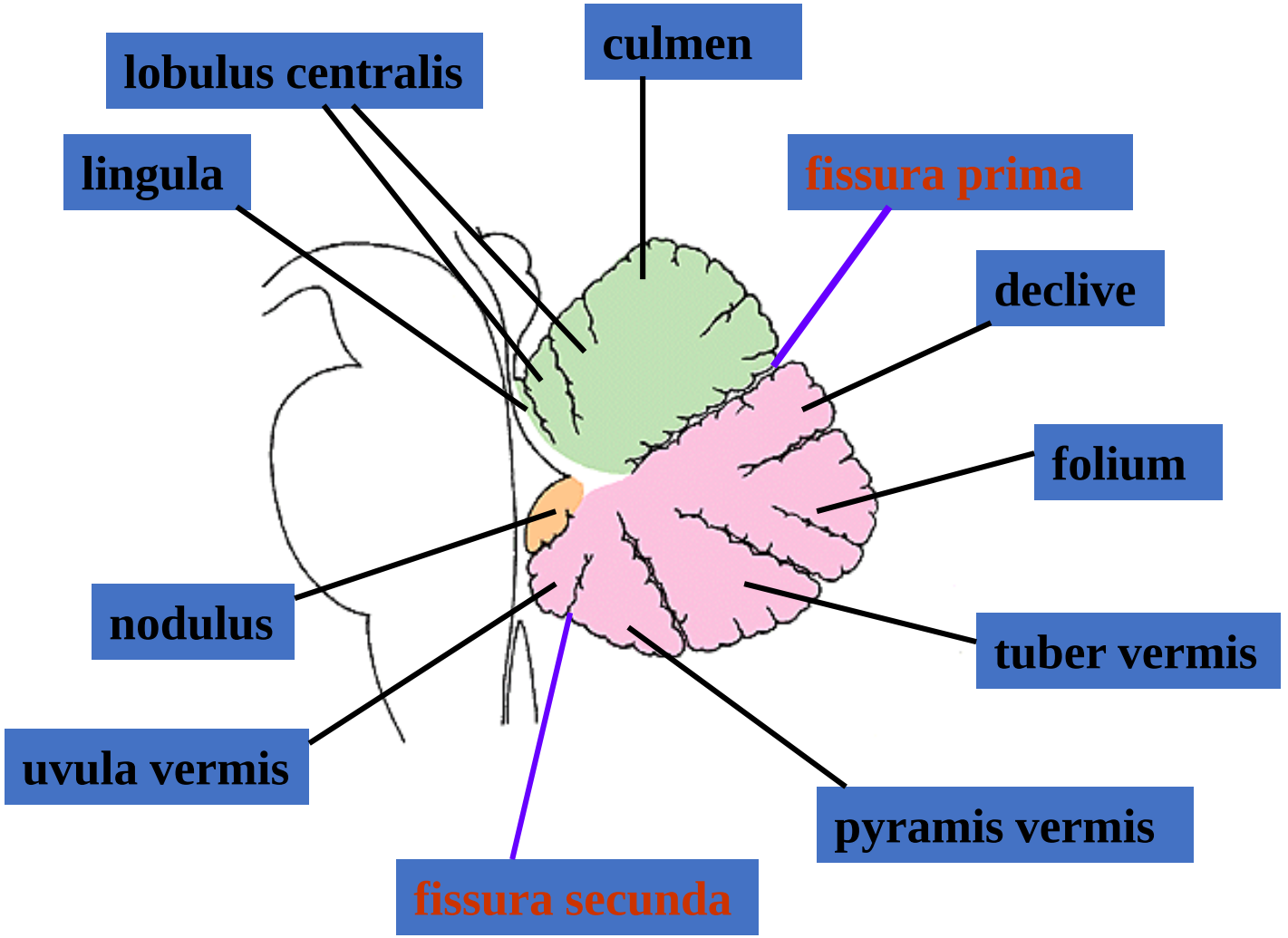
fissura horizontalis

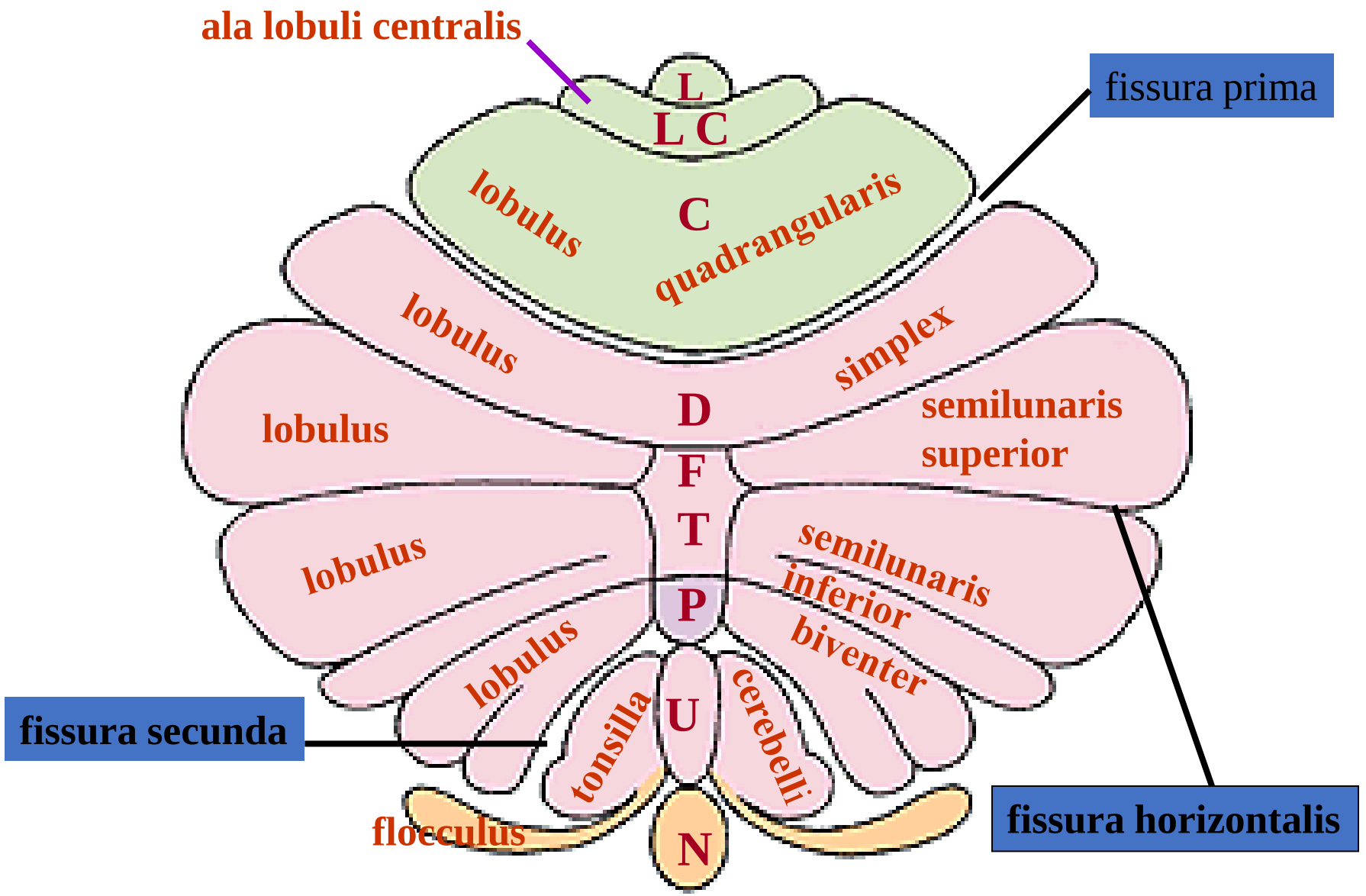
fissura posterolateralis


lobus cerebelli anterior
nodulus
lobus cerebelli posterior

Functional Section	Vermis section	Hemisphere section
	Lingula	
Lob. cerebelli ant.	Lobulus centralis.....	Ala lobuli centralis
	Culmen.....	Lobulus quadrangularis (pars anterior)
	Fissura prima	
	Declive.....	Lobulus simplex (lobulus quadrangularis) (Pars inferoposterior)
	Folium vermis.....	Lobulus semilunaris superior
	Fissura horizontalis	
Lob. cerebelli post.	Tuber vermis.....	Lobulus semilunaris inferior
	Pyramis vermis.....	Lobulus biventer
	Fissura secunda	
	Uvula vermis.....	Tonsilla cerebelli
	Fissura posterolateralis	
Lob. flocconodu.	Nodulus.....	Flocculus


flocculus


lobulus centralis
culmen
lingula
fissura prima
declive
folium
nodulus
tuber vermis
uvula vermis
pyramis vermis
fissura secunda


ala lobuli centralis
fissura prima
L
L C
C
lobulus
quadrangularis
lobulus
simplex
lobulus
D
semilunaris
superior
F
T
lobulus
semilunaris
inferior
P
biventer
lobulus
fissura secunda
tonsilla
U
cerebelli
flocculus
N
fissura horizontalis

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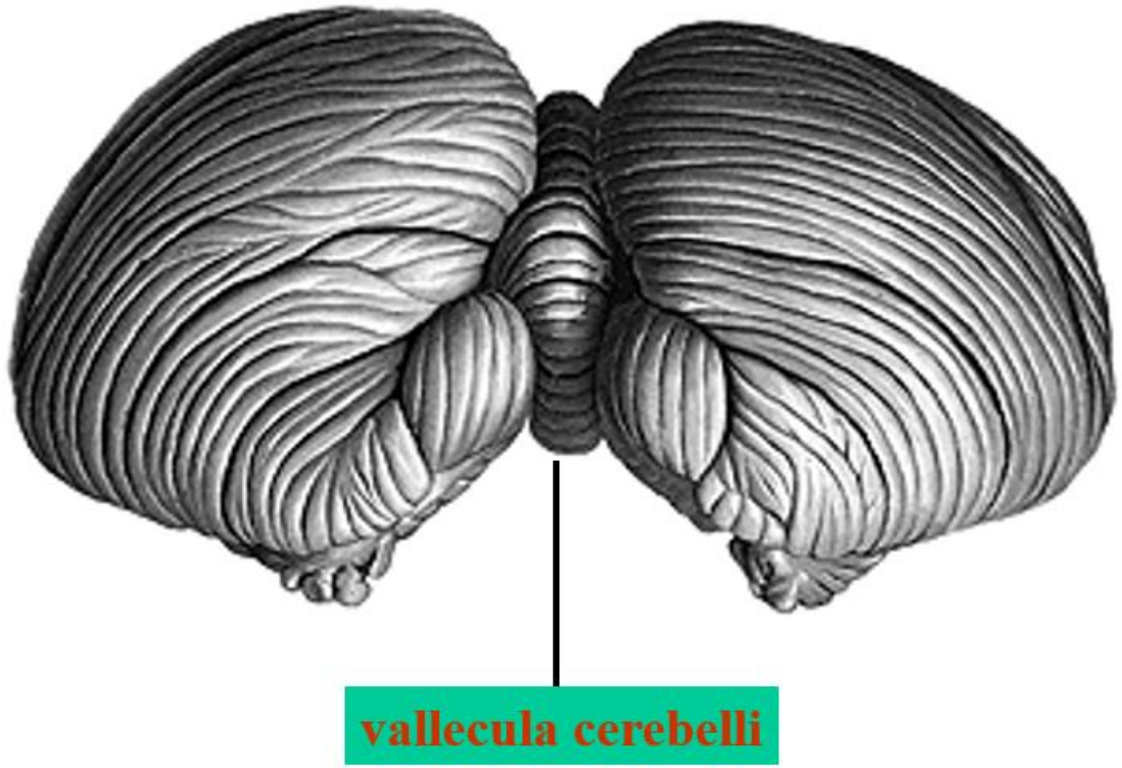
- The lower surface of the cerebellum is more convex than its upper surface, and the deep notch in the middle where the vermis is located is called the vallecula cerebelli.



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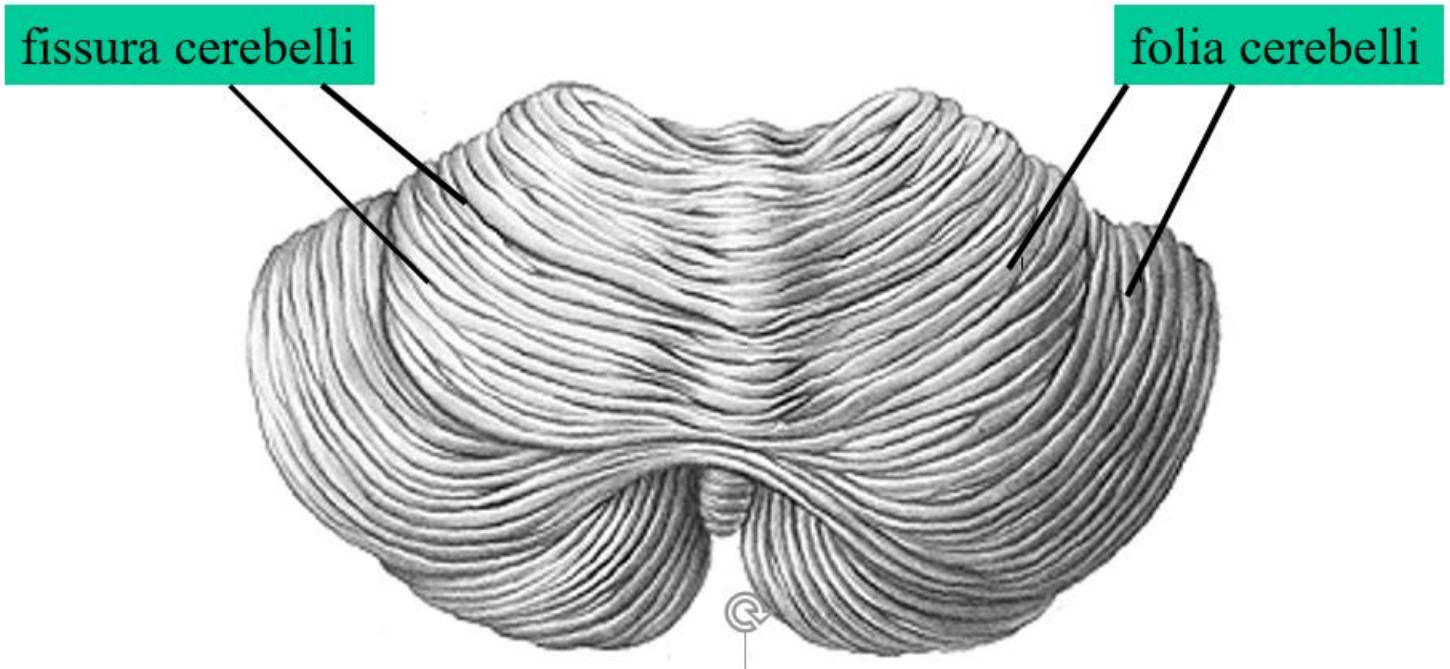
- The outer surface of the cerebellum consists of leaflets (folia cerebelli) extending in the transverse direction and separated from each other by slits called fissura cerebelli.
- These structures continue uninterrupted in the vermis.



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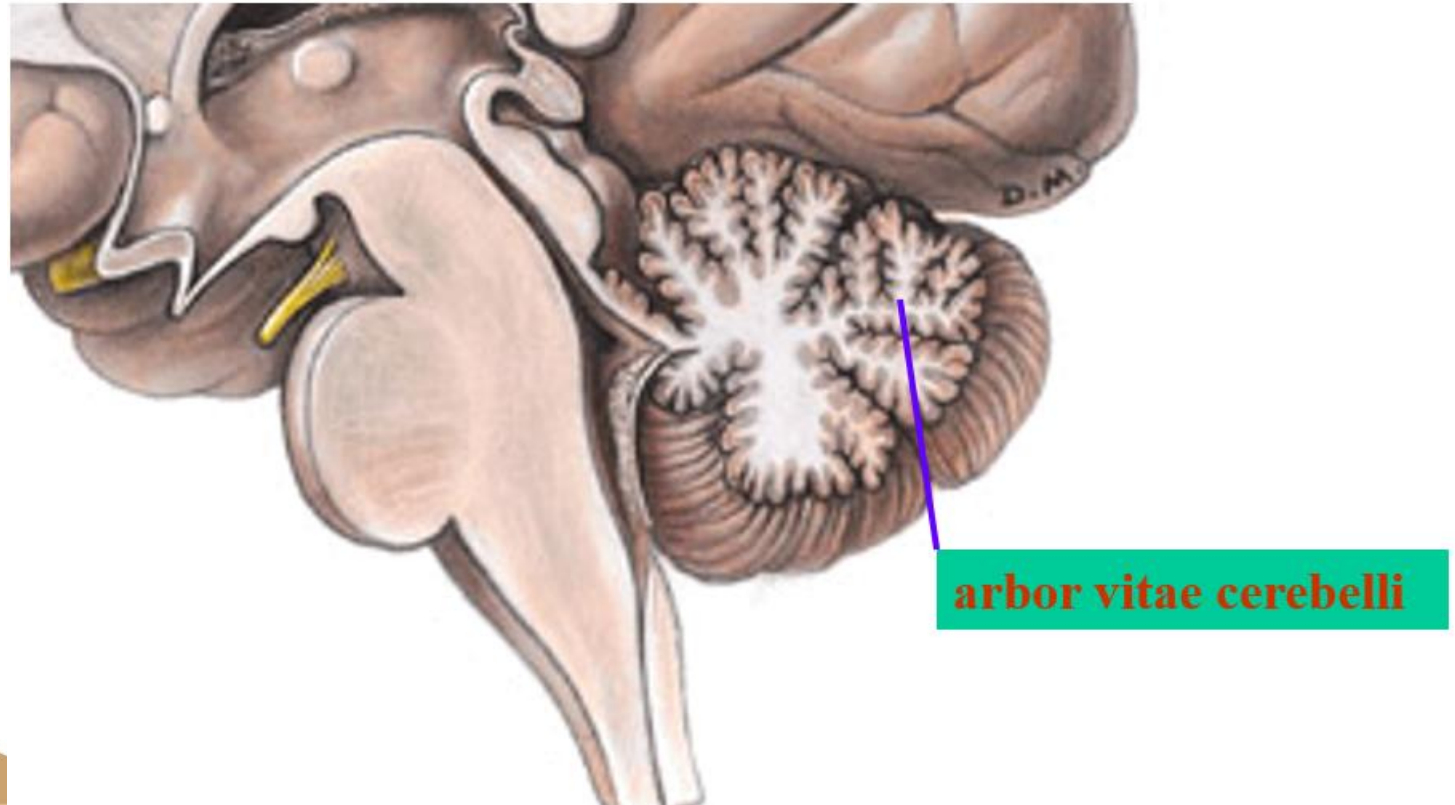
- Folia cerebelli has outer gray matter and inner white matter. In the central sagittal section, the white matter resembles a tree. For this reason, the white matter is called arbor vitae cerebelli.



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- Internal structure of the cerebellum: It consists of gray matter on the outside and white matter on the inside.
- The gray matter on its outer surface is called the cortex cerebelli.
- The gray matter masses embedded in the white matter form the nuclei of the cerebellum (nuclei cerebelli).
- The white matter of the cerebellum is called the corpus medullare, and the leaves are called laminae albae.

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- Cortex cerebelli: It has a pleated appearance with many slits (fissura cerebelli) extending in the transverse direction.
- Deep in each pile or leaf is white matter. Cortex cerebelli consists of three layers from outside to inside:
- 1-stratum moleculare (plexiforme),
- 2-stratum neuronorum piriformium (Purkinje cells layer)
- 3-stratum granulosum.

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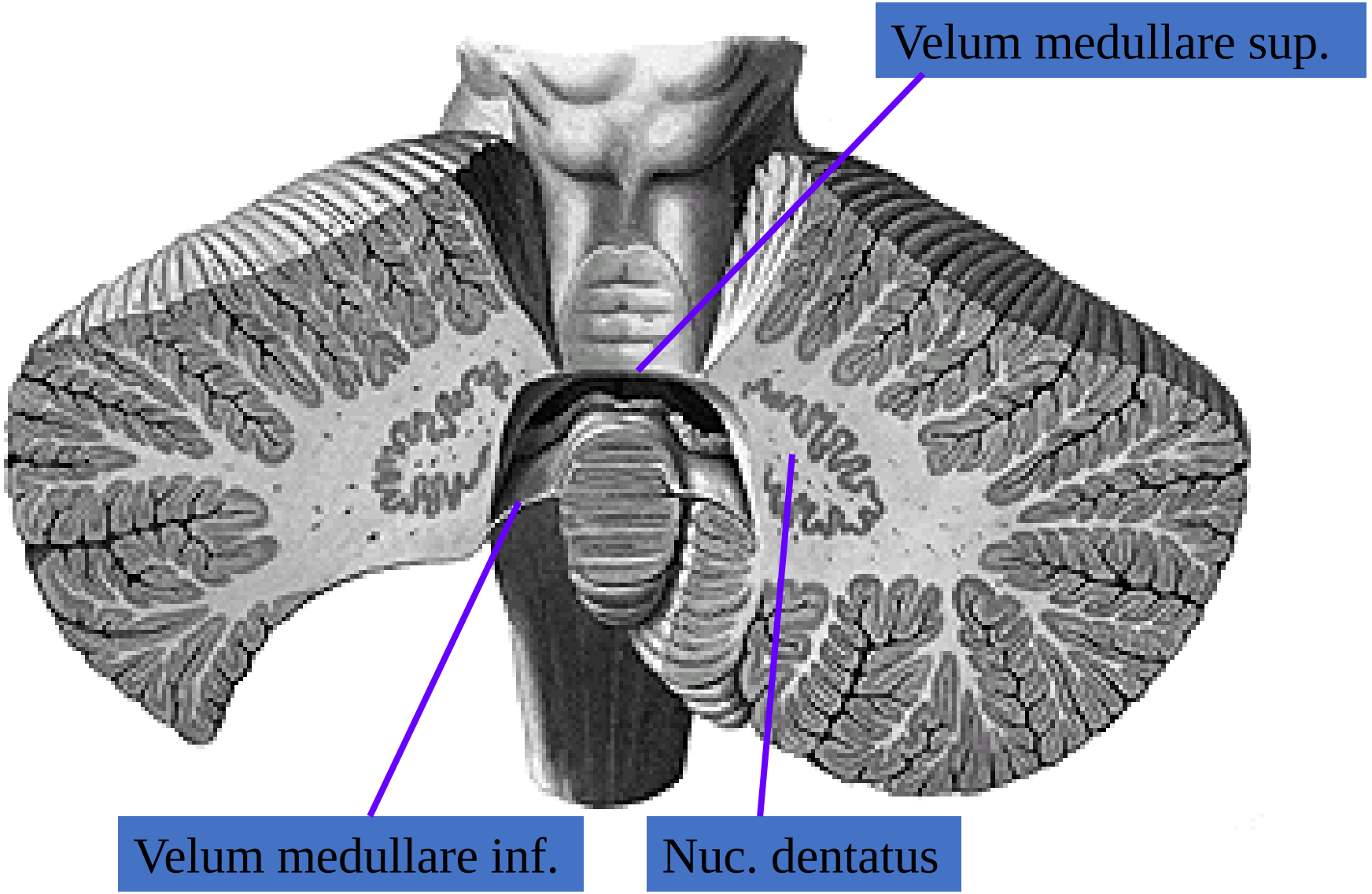
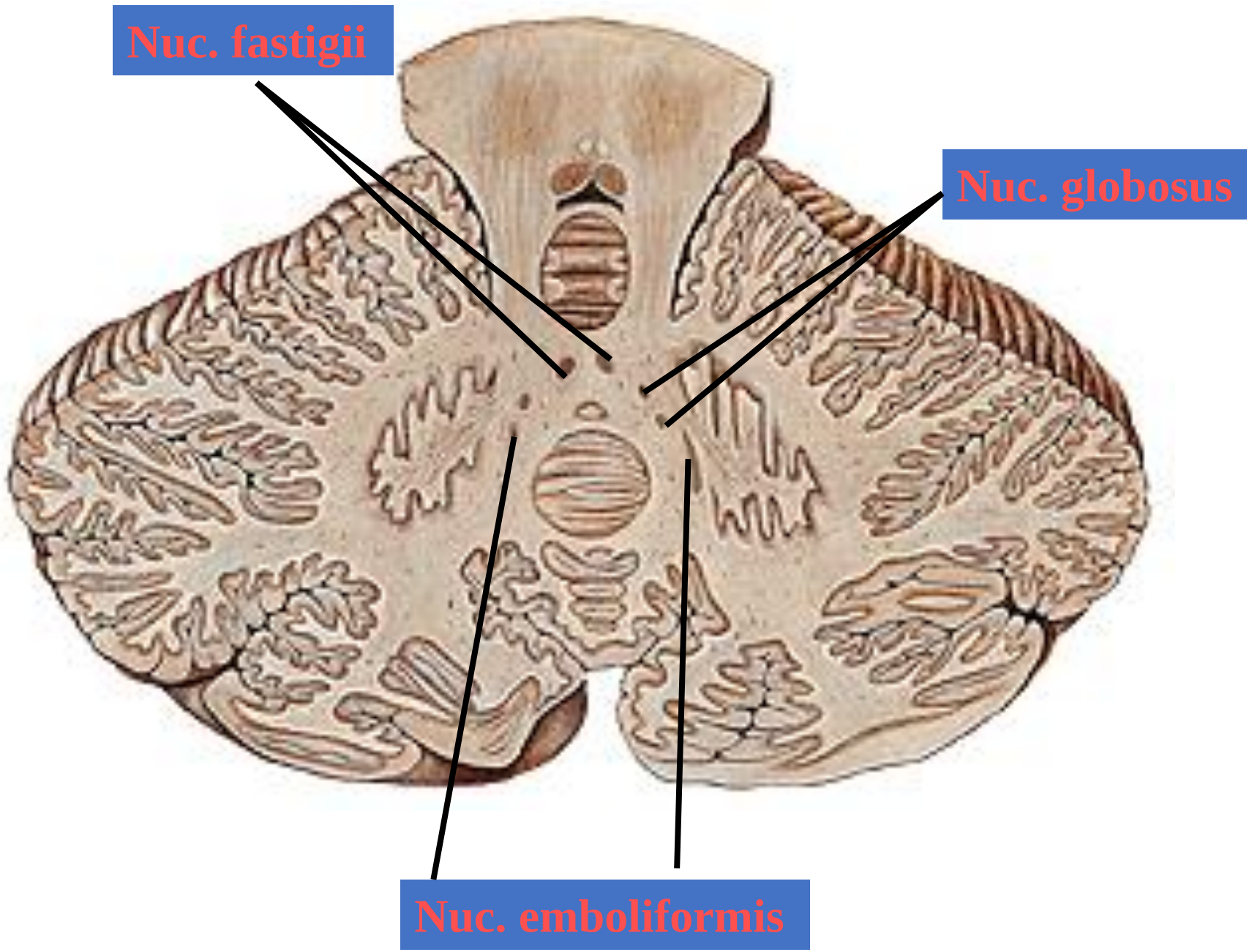
- Cerebellum nuclei (nuclei cerebelli): Gray matter masses embedded in white matter are called nuclei cerebelli. The white matter of the cerebellum has 4 pairs of nuclei. These :
- nucleus dentatus
- nucleus emboliformis
- nucleus globosus
- nucleus fastigii


Velum medullare sup.
Velum medullare inf.
Nuc. dentatus


Nuc. fastigii
Nuc. globosus
Nuc. emboliformis

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- Nuc. dentatus (nuc. lateralis cerebelli): It is the largest cerebellum nucleus, a convoluted lamina of gray matter with white matter in the middle.
- There is no gray matter in the inner part of the core. It is in the shape of an inward-facing bowl, like the nucleus olivaris inferior.
- The mouth of the bowl is directed forward and medially. This is called the hilum nuclei dentati. Nuc. In the dentatus, the axons of the Purkinje cells terminate.
- Fibers starting here, nuc. It arises from the mouth of the dentatus (hilum nuclei dentati), passes through the pedunculus cerebellaris superior, and connects the cerebellum to the cerebral cortex via the thalamus.

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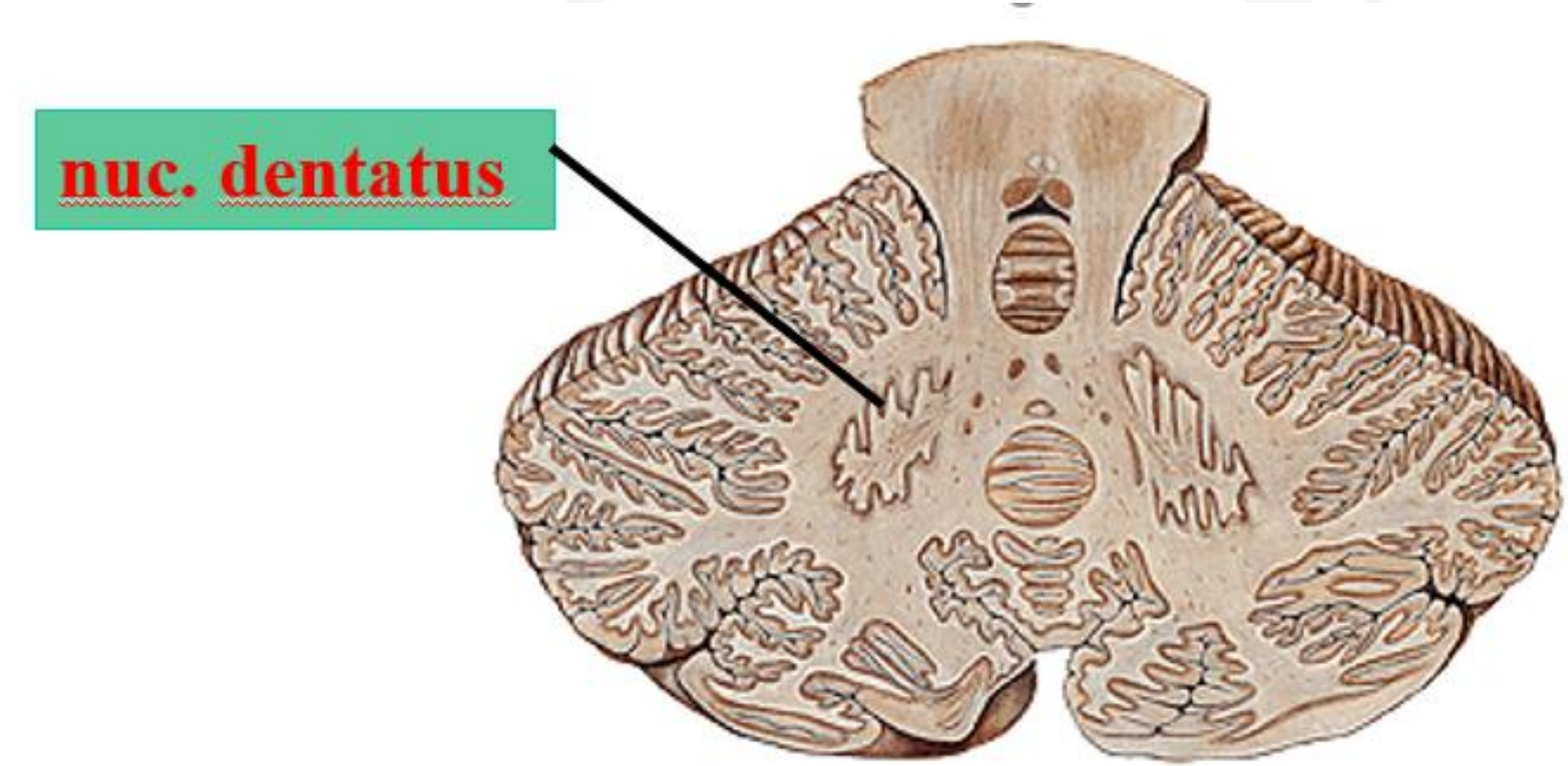

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- Nuc. emboliformis (nuc. interpositus anterior): Nuc. It is a small oval-shaped nucleus located medial to the dentatus.

- Nuc. globosus (nuc. interpositus posterior): Nuc. It consists of small groups of cells located medial to the emboliformis.

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- Nuc. fastigii (nuc. medialis cerebelli): It is located at the anterior end of the upper part of the vermis and close to the midline. There is only a thin layer of white matter between this nucleus, which is near the ceiling of the 4th ventricle, and the 4th ventricle.
- Cerebellum nuclei consist of large multipolar nerve cells. Fibers from the cerebellum leave the cerebellum via the pedunculus cerebellaris superior and inferior.

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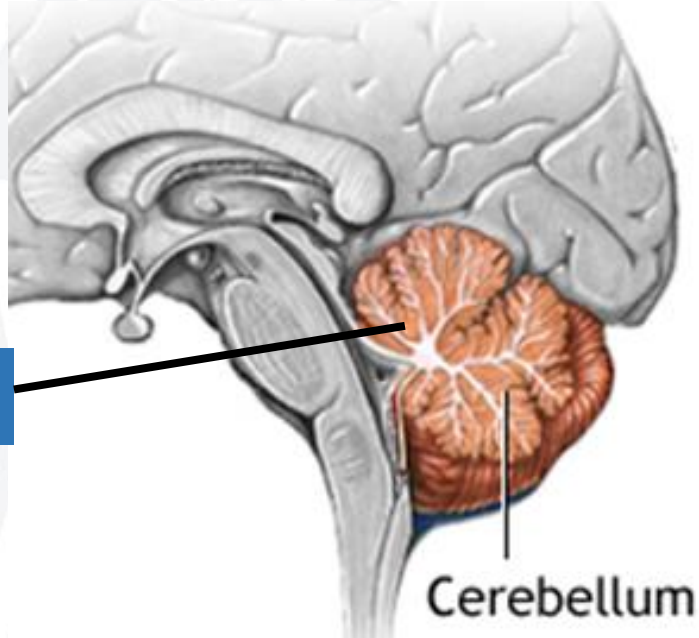
- White matter of the cerebellum:
- A small amount of white matter is found in the vermis. It is called arbor vitae cerebelli because it resembles a tree in sagittal section. More white matter is found in the cerebellum hemispheres.
- There are three types of fibers in the white matter of the cerebellum. a) intermediate (inner) fibers
- b) afferent fibers
- c) efferent fibers.



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- Intermediate fibers connect within the cerebellum and do not leave the cerebellum. Some of them connect the hemispheres of the two sides.
- Afferent fibers make up most of the white matter. These fibers, which enter the cerebellum mainly through the pedunculus cerebellaris medius and inferior, terminate in the cerebellar cortex.

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- Efferent fibers begin as axons of Purkinje cells in the cerebellar cortex, and most of them replace neurons in the cerebellum nuclei.
- Fibers that synapse in the nucleus dentatus, nucleus emboliformis, and nucleus globosus leave the cerebellum from the pedunculus cerebellaris superior, and those that synapse in the nucleus fastigi leave the pedunculus cerebellaris inferior.
- The axons of Purkinje cells in the lobus flocculonodularis and part of the vermis pass through the nuclei of the cerebellum without synapses.

Functional Anatomy of the Cerebellum

- The cerebellum is phylogenetically divided into archiocerebellum, paleocerebellum, and neocerebellum.
- Archicerebellum: Lobus flocculonodularis is the oldest part of the cerebellum and is called the archicerebellum.
- archicerebellum; It receives its afferents from the balance organs and vestibular nuclei in the inner ear. By evaluating these sensory impulses, it connects with lower motor neurons in the spinal cord through tractus vestibulospinalis, tractus rubrospinalis, tractus reticulopspinalis, and FLM.
- It helps to maintain the balance of the body and understand our position in space by adjusting the muscle tone.
- In its lesion, the patient walks swaying like a drunk.

Paleocerebellum

- The entire lobus anterior and the pyramis and uvula parts of the lobus posterior are collectively called the paleocerebellum. This more recent section deals with rough movements of the head and trunk.
- This section; evaluates proprioceptive (kinesthetic) and pressure-contact sensations from muscles, tendons and joints via tr. spinocerebellaris anterior, tr. spinocerebellaris posterior, tr. cuneocerebellaris, tr. spinoreticularis and its successor, tr. reticulocerebellaris.
- It acts by transmitting them to the anterior horn motor cells via tr. vestibulospinalis, tr. rubrospinalis, tr. reticulopspinalis.

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- **Paleocerebellum:** Adjusts the tone of the muscles and allows the muscle groups to work together. It plays an important role in performing voluntary movements fluently and regularly and in maintaining our position.
- In the lesion, the tone of the extensor muscles increases and we have difficulty in maintaining our position.

Neocerebellum

- The posterior parts of the lobe, except for the uvula and pyramis, are called the neocerebellum.
- **Neocerebellum**; It receives a wide variety of sensory impulses from both the cerebral cortex and the spinal cord.
- As a result of these impulses it receives, it sends the impulse it integrates to the cerebral cortex via the thalamus.
- As a result of this stimulation it receives in the cerebral cortex, it affects the anterior horn motor neurons of the spinal cord and the somatomotor neurons of the cranial pairs via tractus corticospinalis.

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- This part of the cerebellum regulates the regular, fluent and coordinated movements of our voluntary movements, the width, direction, and strength of the movement.
- We cannot perform the movements that require skill in the lesion, our speech is impaired. In addition, hypotonia, asyenergia, dysmetria, ataxia and nystagmus are seen.

Vermis Lobules

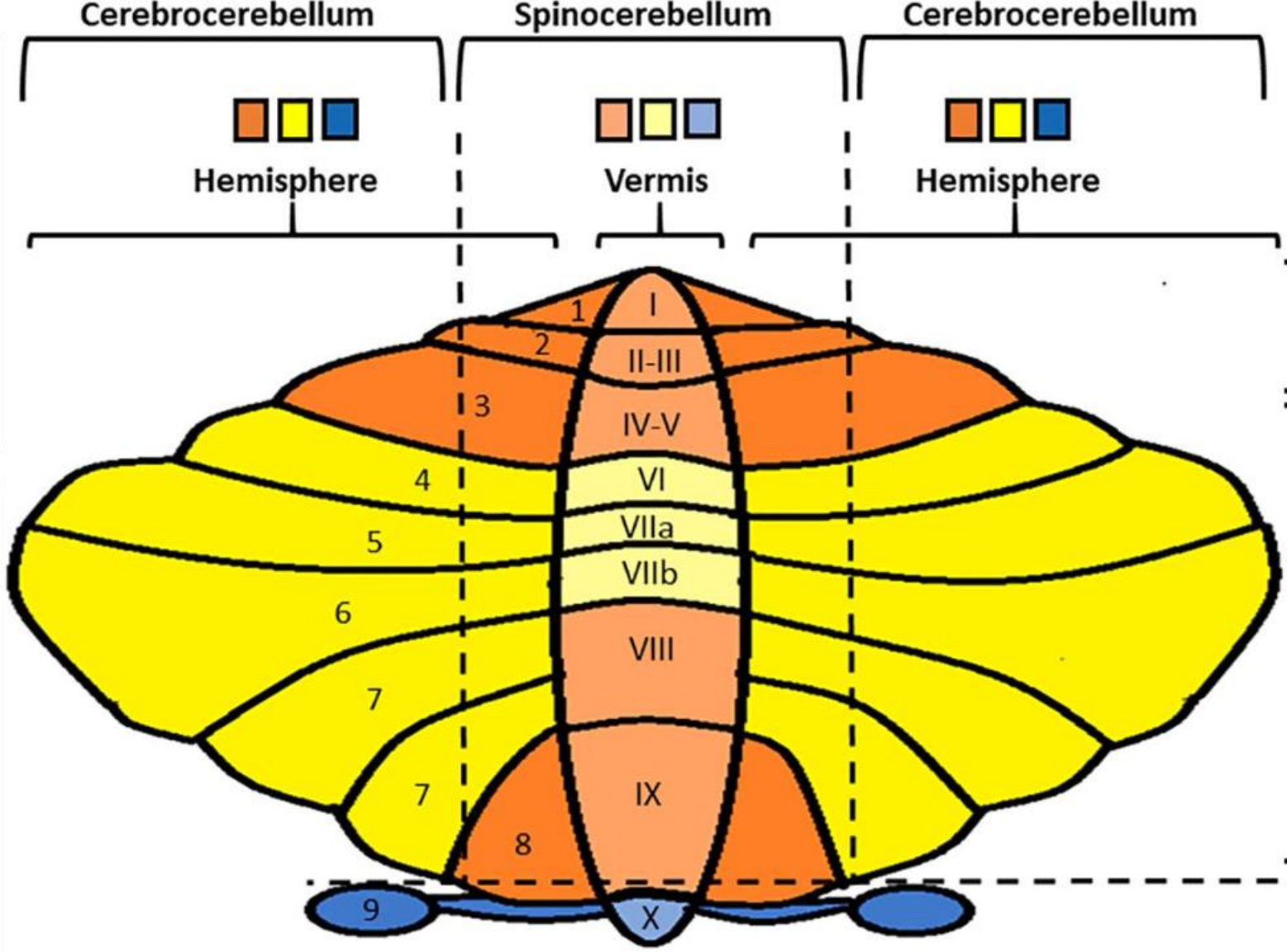
I = Lingula
II-III = Central lobule
IV-V = Culmen
VI = Declive
VIIa = Tuber vermis
VIIb = Folium vermis
VIII = Pyramis
IX = Uvula

Hemisphere Lobules

1. Frenulum
2. Ala
3. Quadrangular lobule
4. Lobus simplex
5. Superior semilunar lobule (Crus I)
6. Inferior semilunar lobule(Crus II)
7. Biventral lobule
8. Tonsil

Archi/Vestibulo-cerebellum

X = Nodulus
9. Flocculus



Paleocerebellum
Neocerebellum
Archicerebellum

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Fibers coming to the cerebellum via the pedunculus cerebellaris inferior

1-Tr. spinocerebellaris posterior

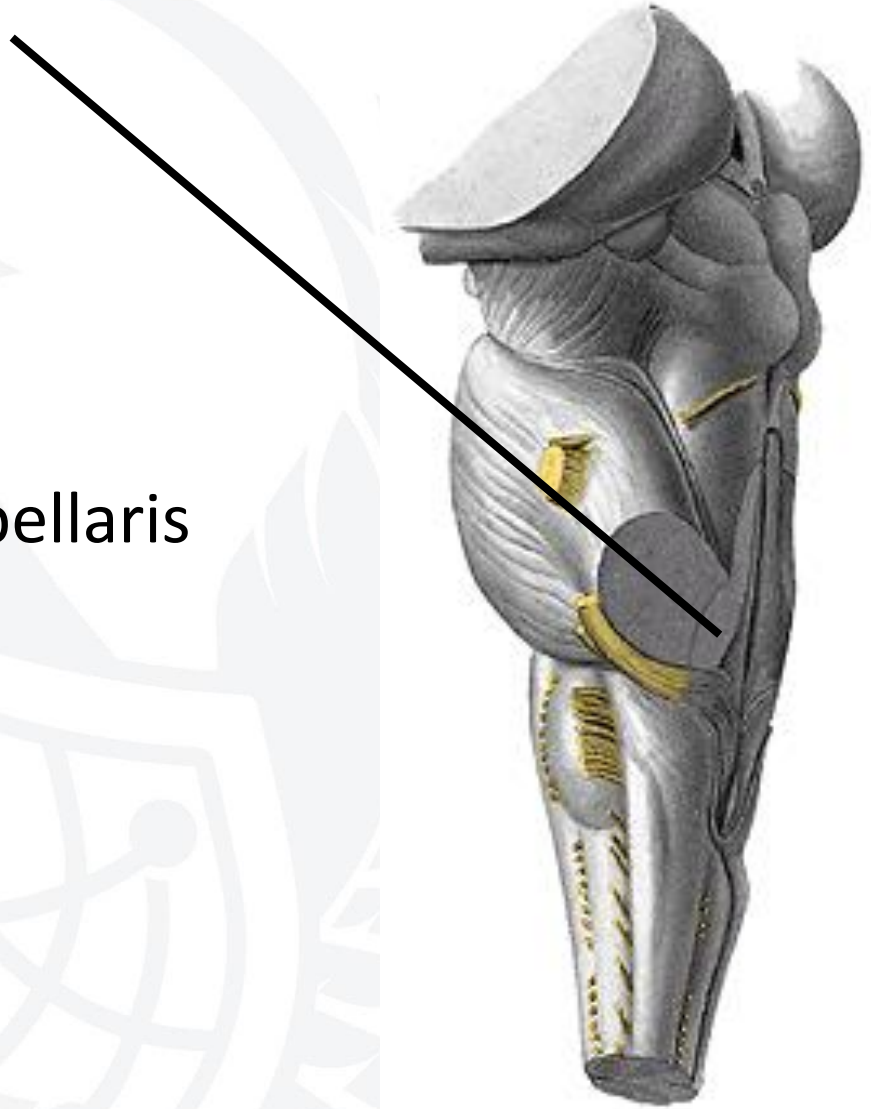
(Flechsig beam),

2-Fibrae arcuatae externae anteriores,

3-Fibrae arcuatae externae post: tr. cuneocerebellaris

4-Tr. olivocerebellaris,

5-Tr. vestibulocerebellaris



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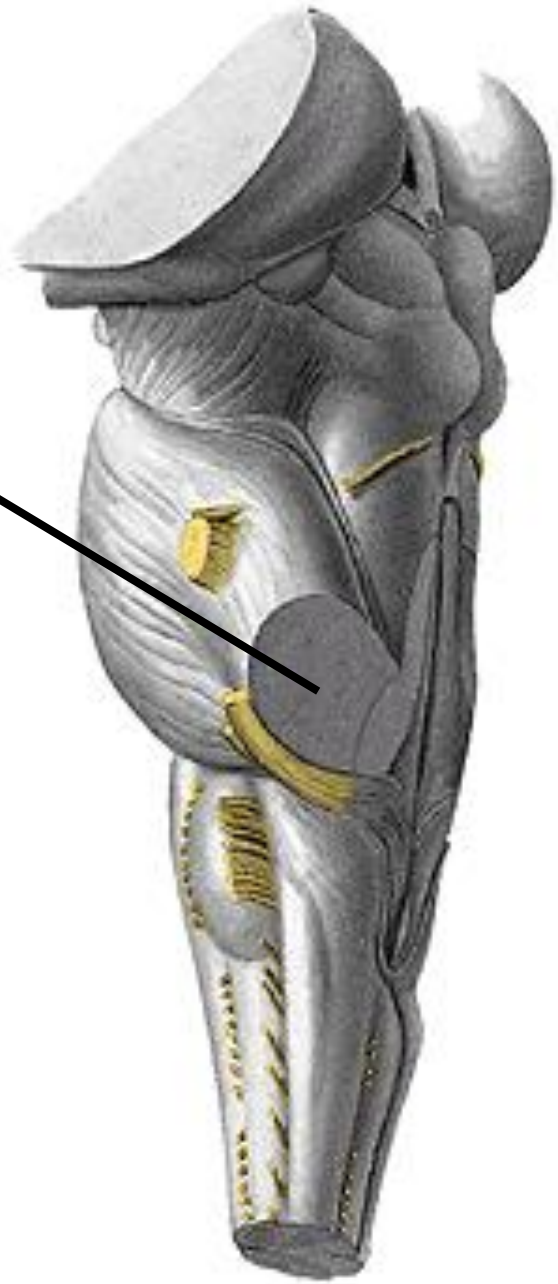
Fibers leaving the cerebellum from the inferior pedunculus cerebellaris

- There are fibers going to the vestibular nuclei and to the formatio reticularis nuclei in the bulbus and pons.

- **The pedunculus cerebellaris medius**;
- consists of afferent fibers.
- These are fibers that originate from the Nuclei pontis. Almost all cross. (tractus pontocerebellaris or 2nd neuron of tractus corticopontocerebellaris).
- This pathway, which connects the brain to the cerebellum and called tractus corticopontocerebellaris, is especially important for the synergistic movements of the muscles.



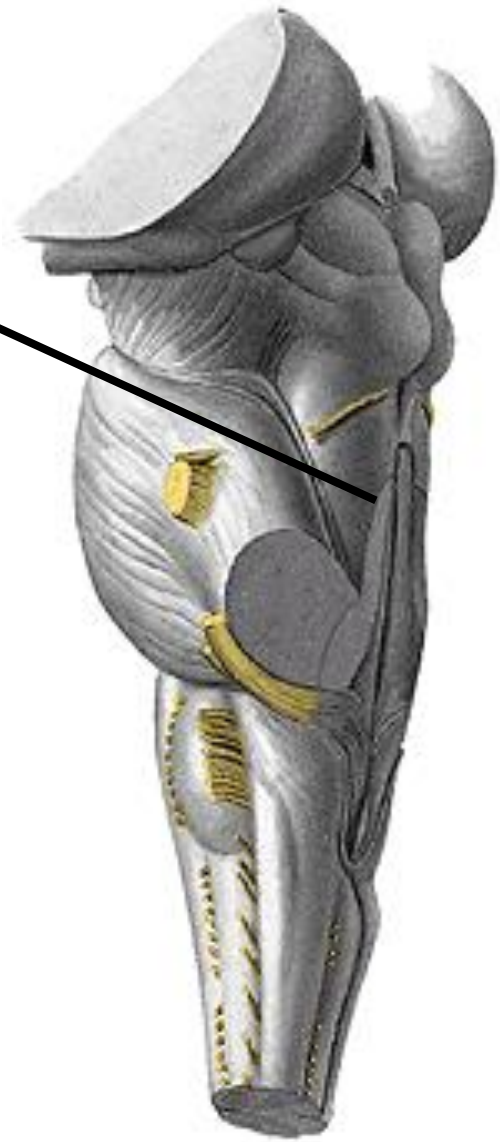
Pedunculus cerebellaris superior

Most of them are efferent fibers.

It goes to the tegmentum of the mesencephalon.

It leaves the nucleus dentatus and goes to the cerebral cortex via the thalamus.

A small part consists of afferent fibers. tractus spinocerebellaris anterior 'Gowers'), rubrocerebellar and tectocerebellar fibers.



Pathways of the cerebellum:

- Fibers that bring sensory impulses from the surrounding structures to the cerebellum are called afferent pathways, and fibers that carry impulses from the cerebellum to other structures are called efferent pathways.
- The cerebellum receives impulses from almost every part of the body. Most of the impulses enter from the pedunculus cerebellaris inferior and medius.
- Efferents usually go from the pedunculus cerebellaris superior.
- Their afferents are about 40 times more than their efferents.

Afferent Pathways of the cerebellum:

- **Impulses come to the cerebellum from three different sources.**

- I-) Afferent pathways from Cortex cerebri
- II-) Afferent pathways from the spinal cord
- III-) Afferent pathways coming through the nervus vestibularis

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Afferent pathways from Cortex cerebri:

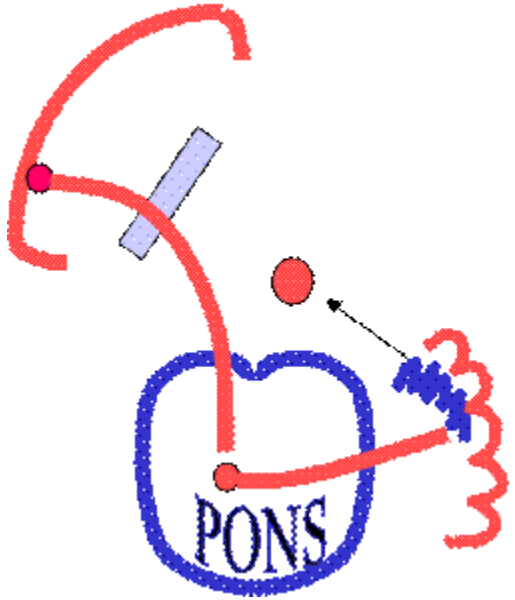
1-Tr. corticopontocerebellaris,

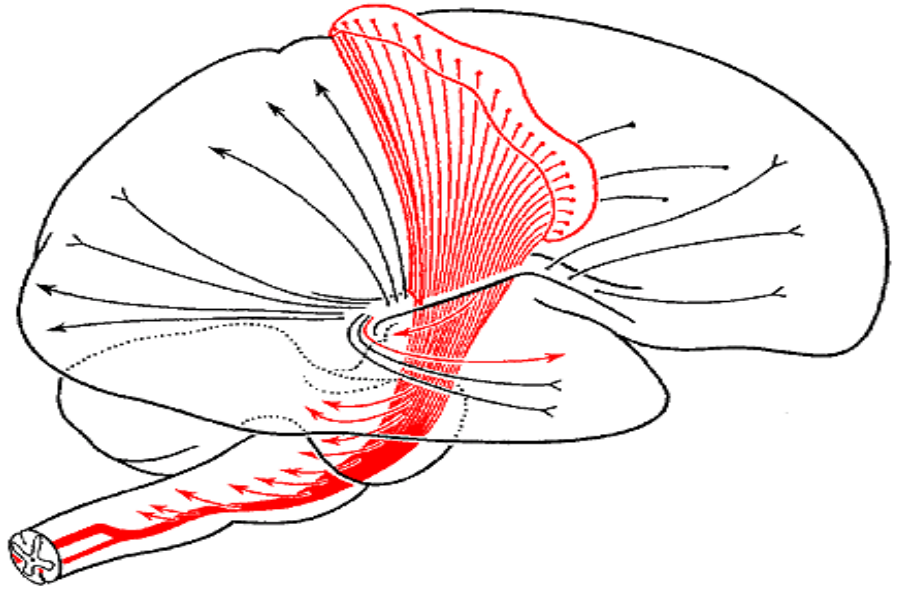
2-Tr. corticoolivocerebellaris

3-Tr. corticoreticulocerebellaris

Tr. corticopontocerebellaris

- Fibers (1st neuron) originating from the cortex of the frontal, parietal, temporal, and occipital lobes pass down the corona radiata and interna capsula to the pons, where they synapse at the nuclei pontis.
- The axons of the 2nd neuron starting from the pons cross the midline and enter the cerebellar half of the opposite side from the pedunculus cerebellaris medius and terminate in the cerebellar cortex.





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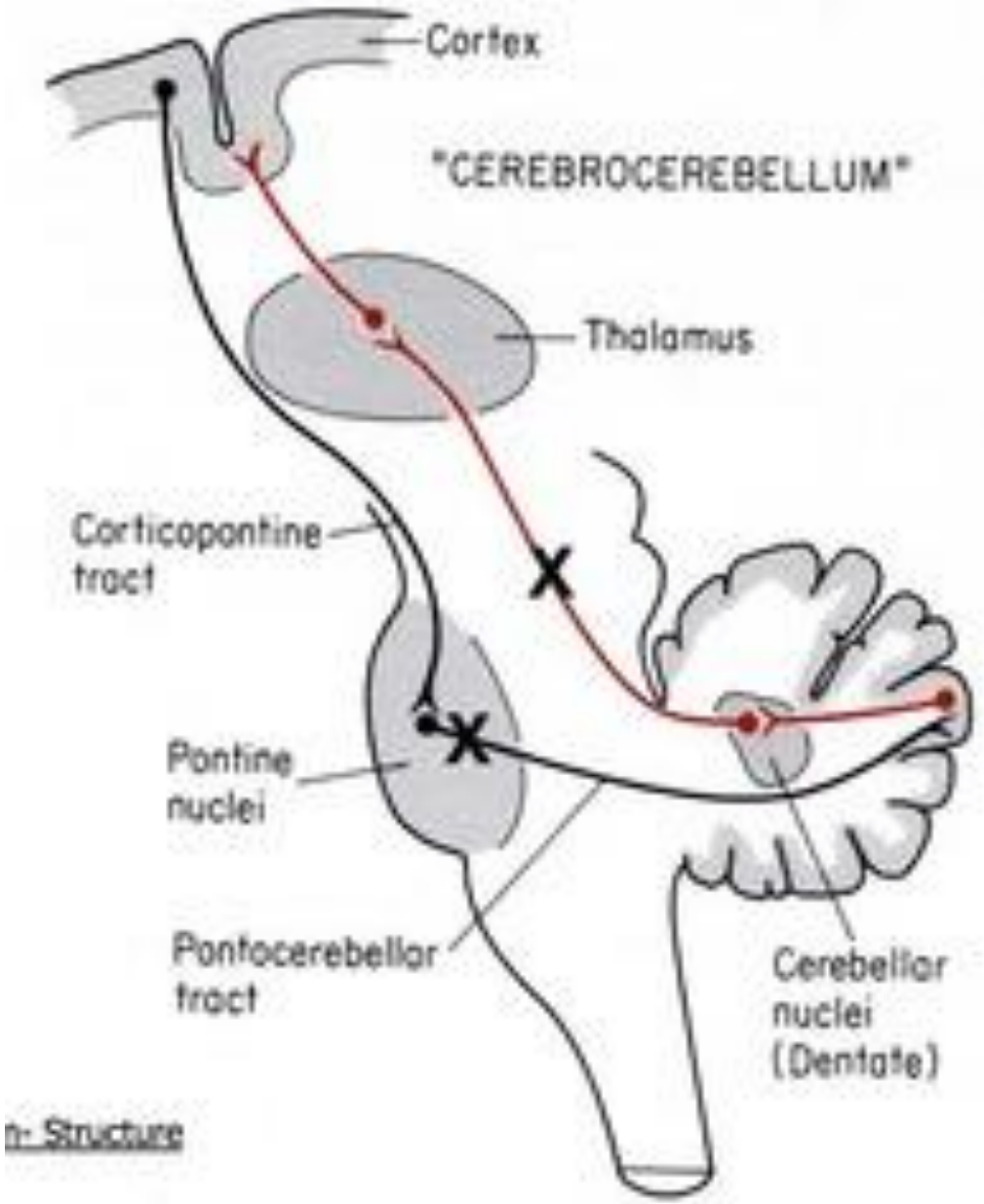

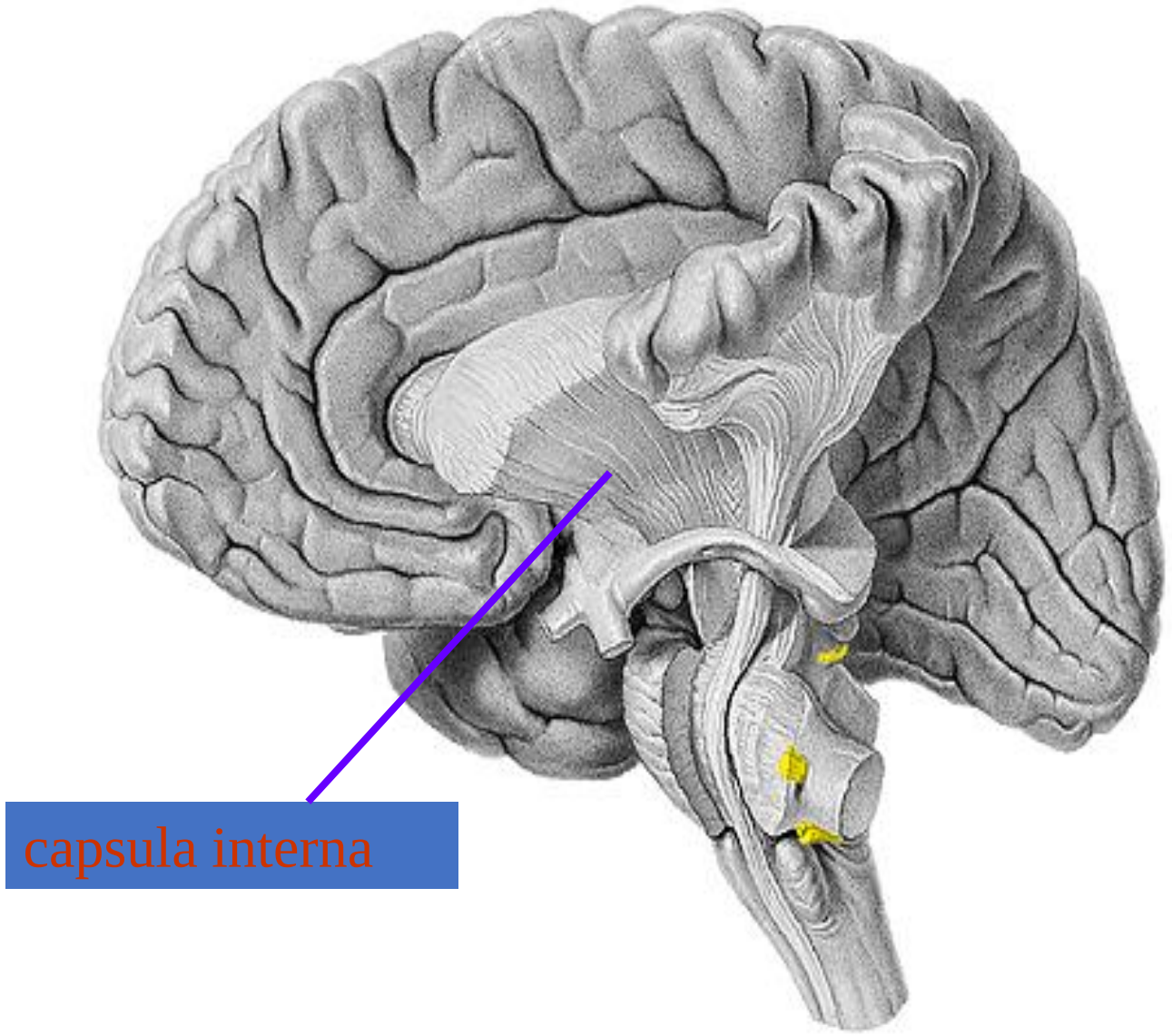
capsula interna

Tr. corticoolivocerebellaris

- Fibers (1st neuron), originating from the cortex of the frontal, parietal, temporal and occipital lobes, pass down the corona radiata and interna capsula and terminate in the nucleus olivaris inferior in the bulb.
- The axons of the 2nd neuron, starting from here, cross the midline and enter the cerebellum half of the opposite side from the pedunculus cerebellaris inferior and end in the cerebellar cortex.

Tr. corticoreticulocerebellaris

- The 1st neuron, which starts from many regions of the cerebral cortex (especially the sensorimotor= 3rd, 1st and 2nd fields), descends and ends in the formatio reticularis of the same side and the bulbus and pons formatio reticularis of the opposite side.
- Starting from the formatio reticularis, the axons of the 2nd neuron enter the cerebellum half of the same side by passing through the pedunculus cerebellaris medius and inferior, and terminate in the cerebellum cortex.
- These connections between the brain and the cerebellum play an important role in the control of voluntary movements.

Pathways from the medulla spinalis to the cerebellum

1-Tr. spinocerebellaris anterior

2-Tr. spinocerebellaris posterior

3-Tr. cuneocerebellaris (Fibrae arcuatae externa posteriores)

Tr. spinocerebellaris anterior (Gowers)

- In this pathway, in addition to the proprioceptive sensory impulse, the exteroceptive (pressure-contact) sensory impulse is also carried.
- It carries the proprioceptive sensation from the muscles and joints of the lower extremities to the cerebellum.
- It plays an important role in the synergetic operation of the muscles and providing balance during movement by providing information to the cerebellum about the state and position of the body part from which the sensation originates.

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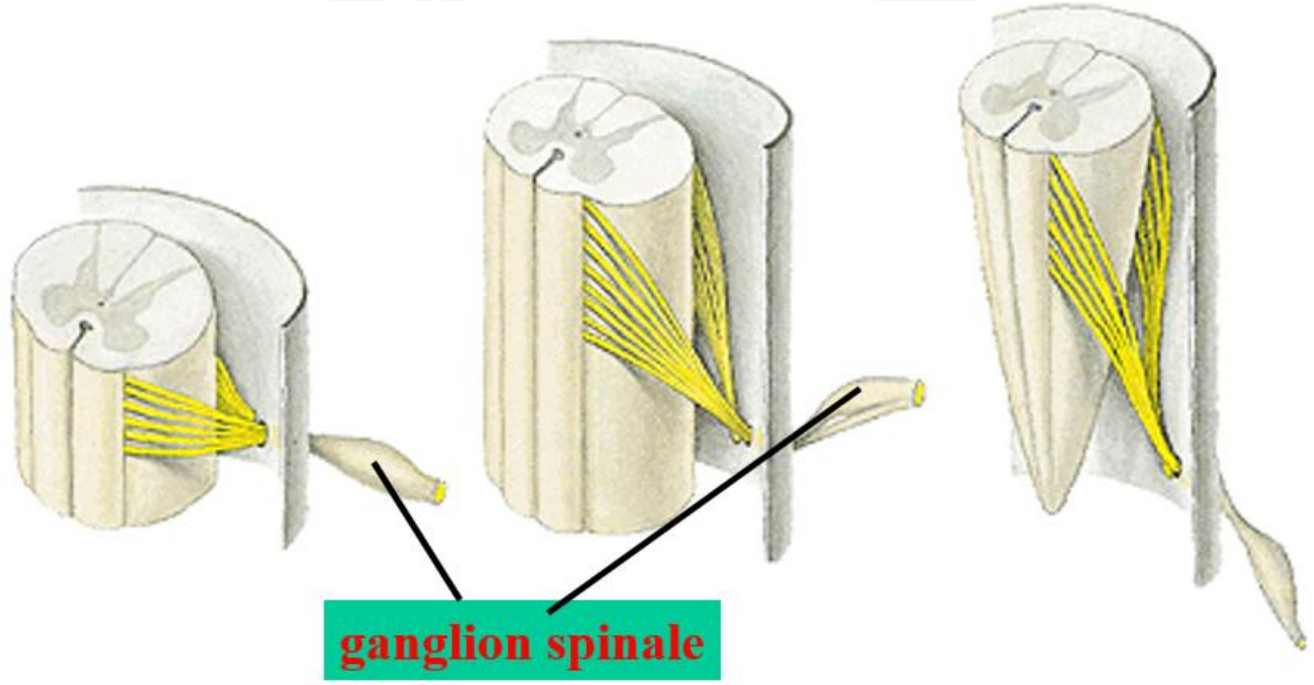
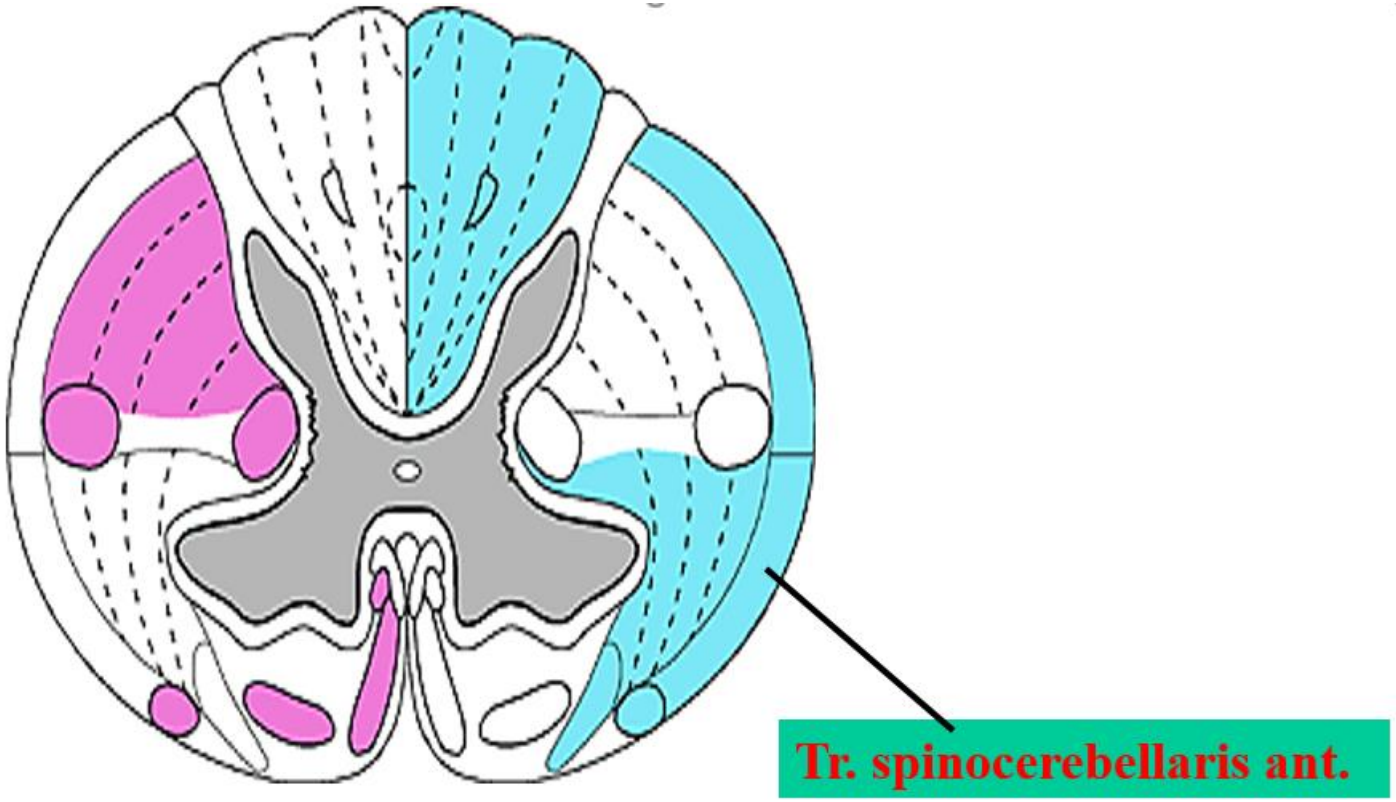
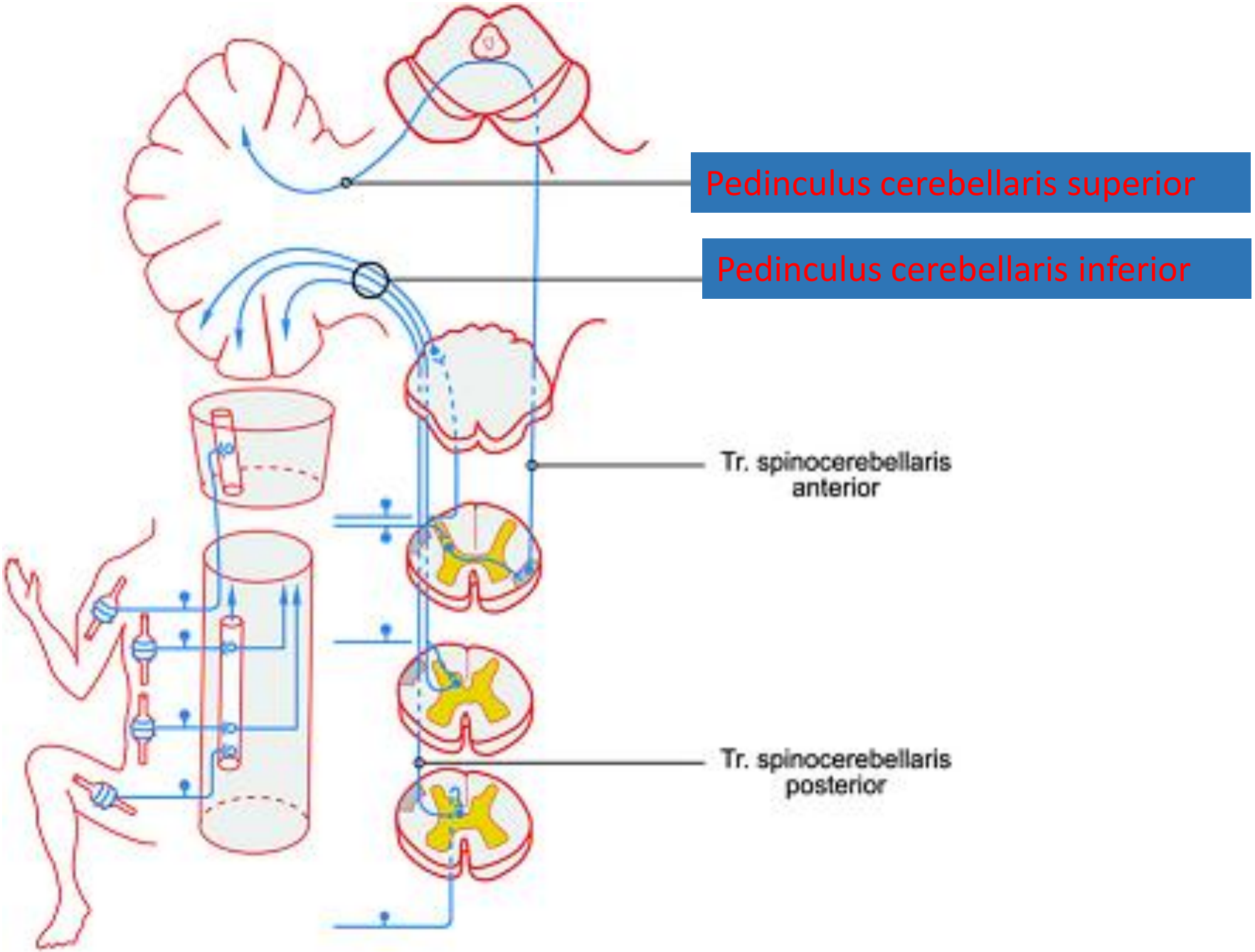
- The cell body of the 1st neuron originating from the muscle, tendon, ligament and joint capsule is located in the ggl. spinale.
- The first neuron, which enters the spinal cord with the dorsal root, synapses in the nucleus thoracicus (dorsalis: Clarke column) in the dorsal horn.



- Most of the 2nd neuron extends upward with the tractus spinocerebellaris anterior of the opposite side and a small portion of the same side.
- This pathway, which runs in the bulbus and pons, passes through the pedunculus cerebellaris superior and ends in the cerebellum hemispheric cortex.




Pedinculus cerebellaris superior
Pedinculus cerebellaris inferior
Tr. spinocerebellaris anterior
Tr. spinocerebellaris posterior

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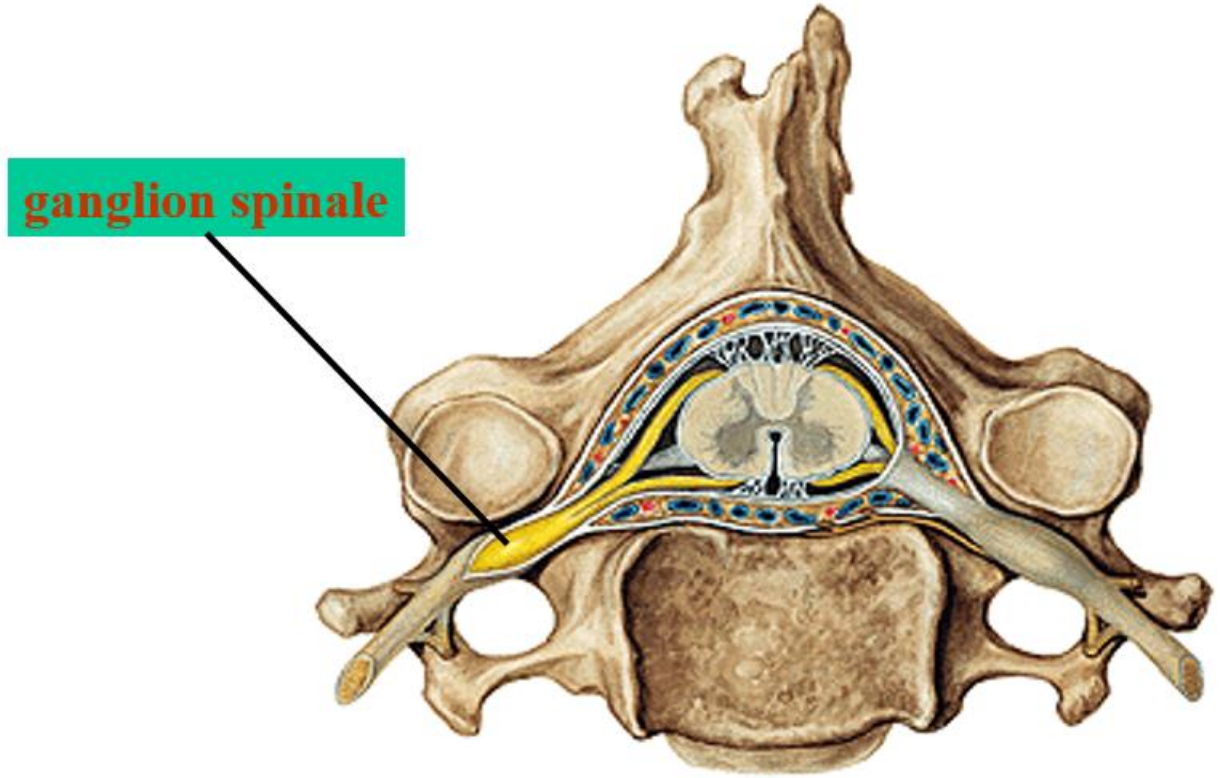
- The fibers that cross in the spinal cord cross again in the cerebellum.
- It is located on the outer side of the tractus spinothalamicus lateralis in the spinal cord of the medulla. Since the nucleus thoracicus T1-L2 (3) is located in the medulla spinalis segments, tractus spinocerebellaris anterior is only in the 2nd (3). We can see it from the lumbar segment level.
- To the spinal cord of the medulla 2 (3). The fibers entering under the lumbar segment first ascend in the funiculus posterior, 2 (3). When they reach the level of the lumbar segment, they enter the gray matter from the posterior horn and synapse in the nucleus thoracicus.

Tr. spinocerebellaris posterior (Flechsig beam)

- It carries the proprioceptive (kinesthetic) sensation from the muscles, tendons and joints of the lower extremities and trunk to the cerebellum.
- Unlike the tractus spinocerebellaris anterior, it is concerned with the fine coordination of each muscle's position and movement.
- For this reason, some proprioceptive sensation from the lower extremity leaves this way at the level of the cerebellum and goes to the cerebral cortex via the nucleus Z.
- Thus, some of the proprioceptive impulses reach our consciousness, and thanks to these senses, we have information about the tension and position of the body part from which the impulse originates.

- The 1st neuron body of the tractus spinocerebellaris posterior is located in the ganglion spinale, and its central extension enters the spinal cord via the posterior root and synapses in the nucleus thoracicus (dorsalis: Clarke column).



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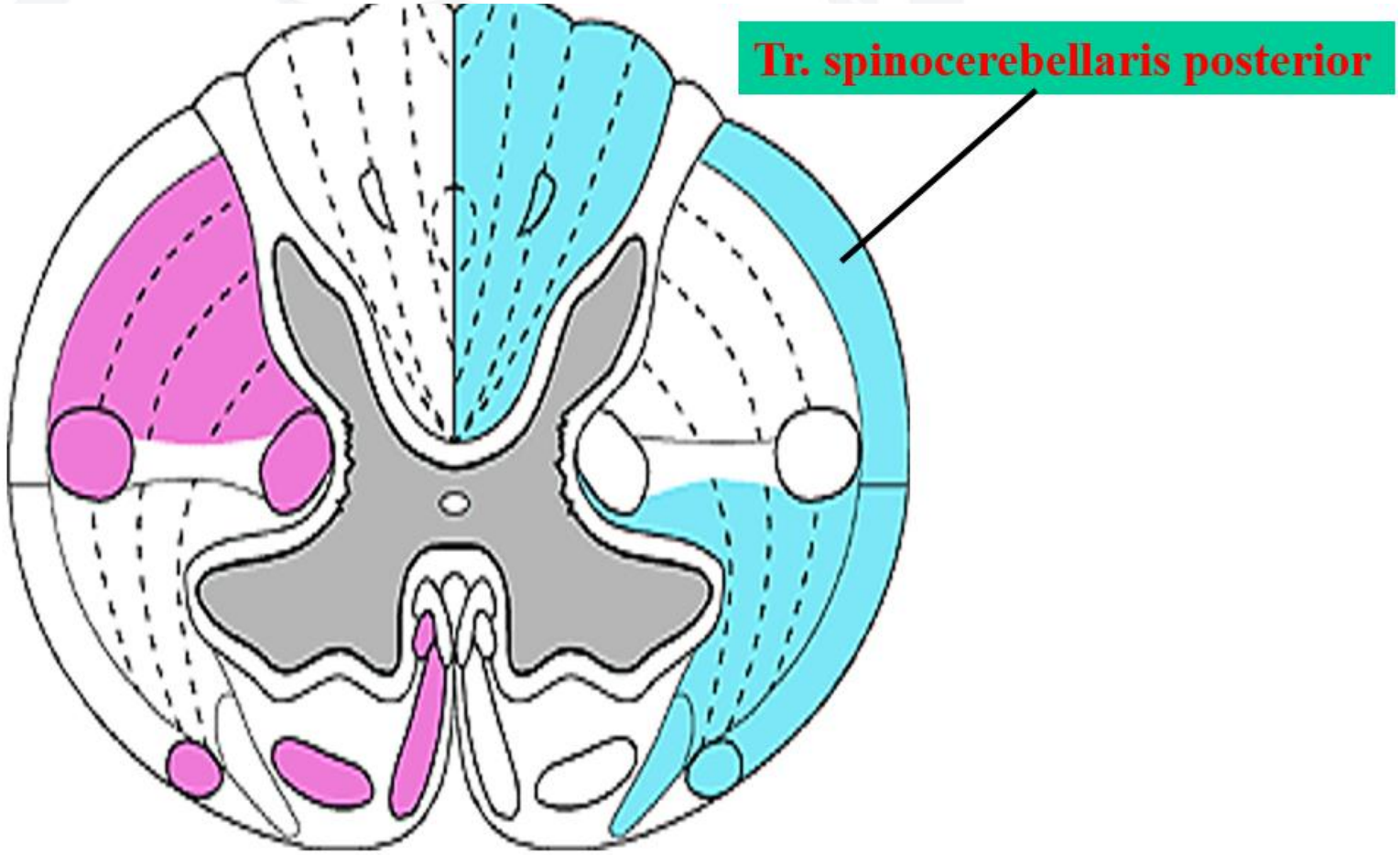
- The axon of the 2nd neuron starting from this nucleus goes up in the posterior-outer part of the funiculus lateralis of the same side and comes to the bulb.



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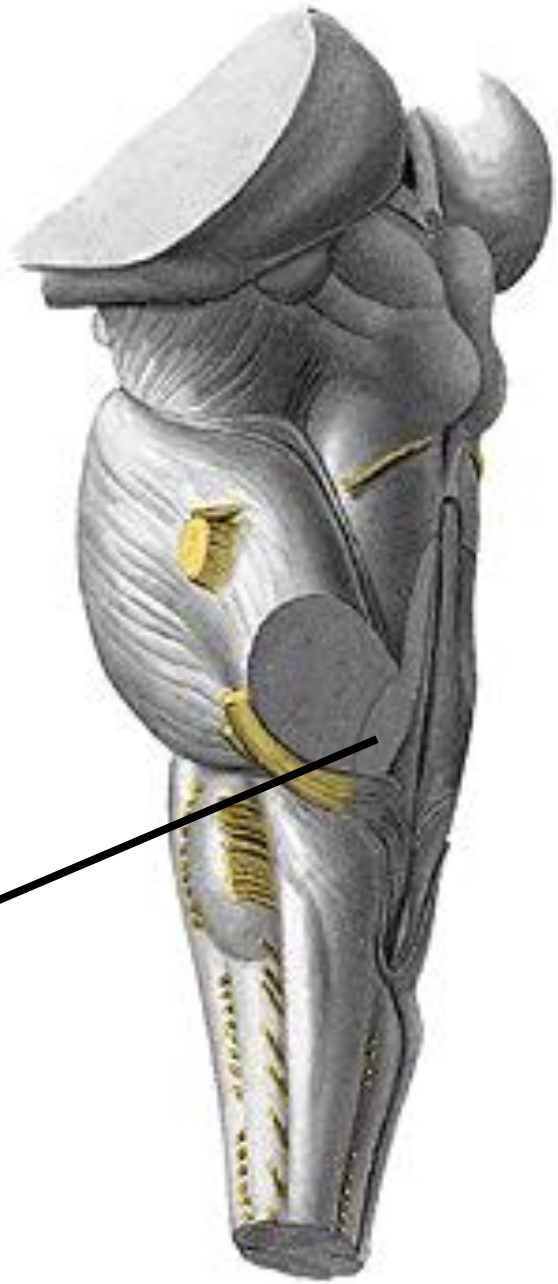
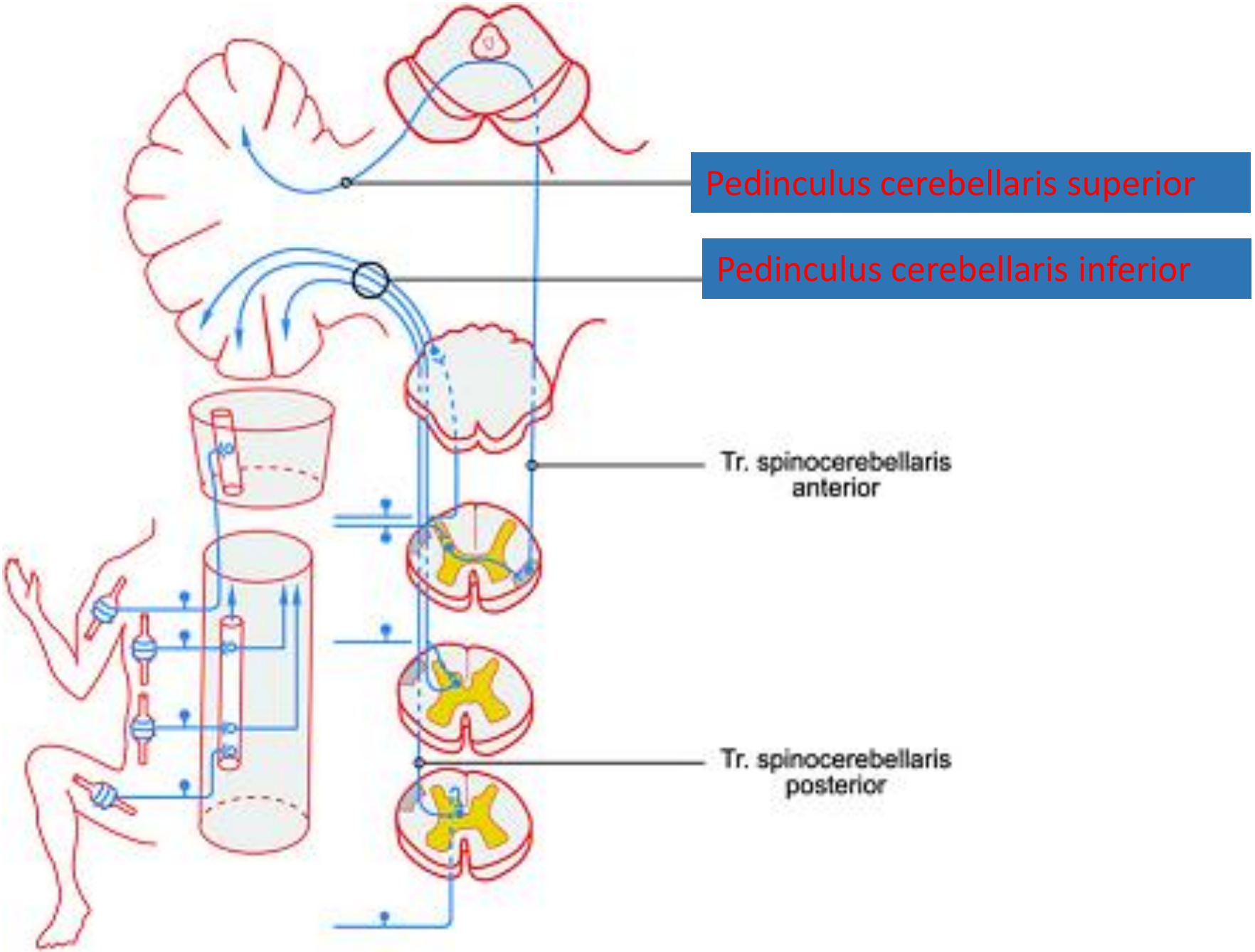
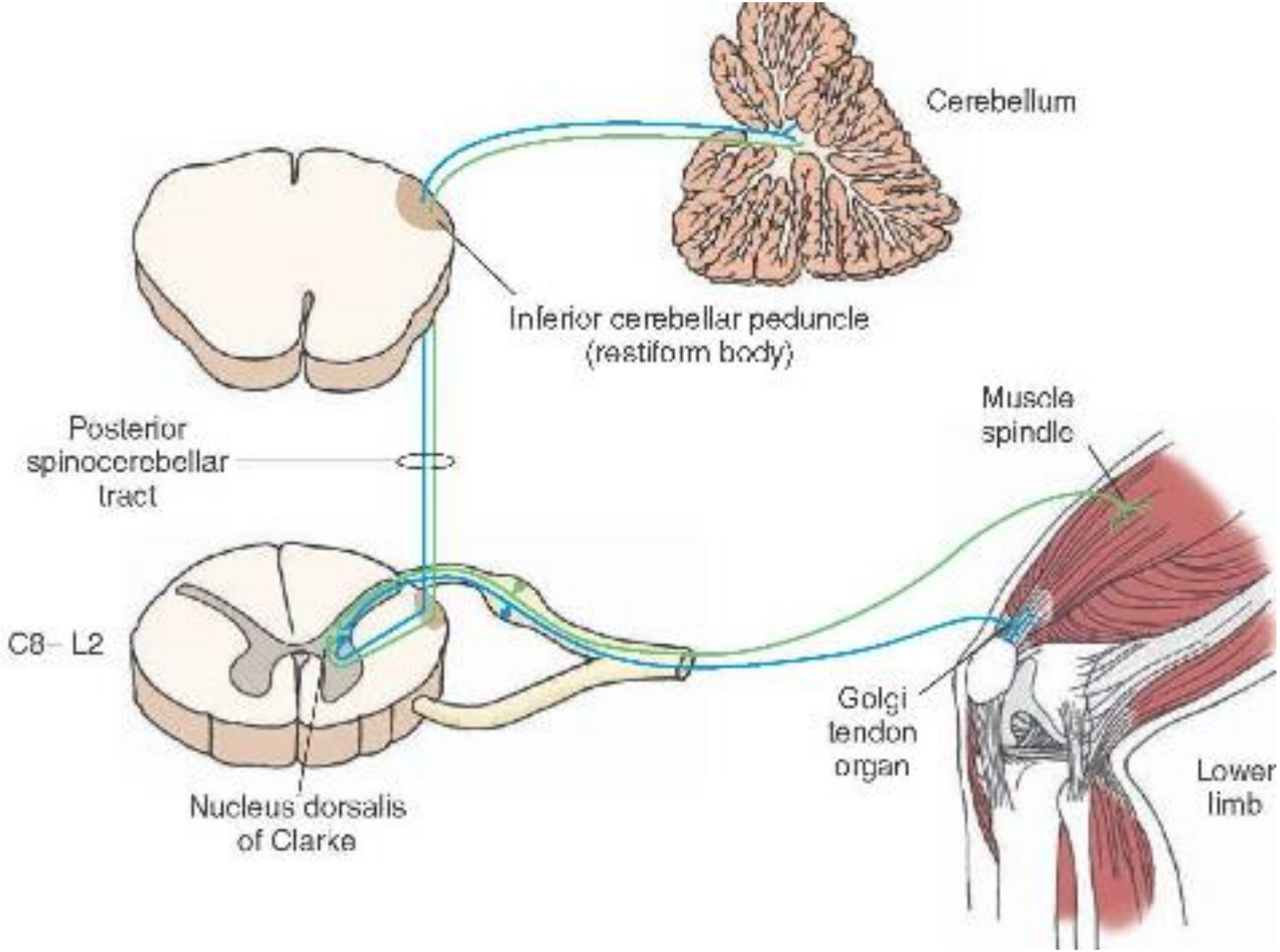
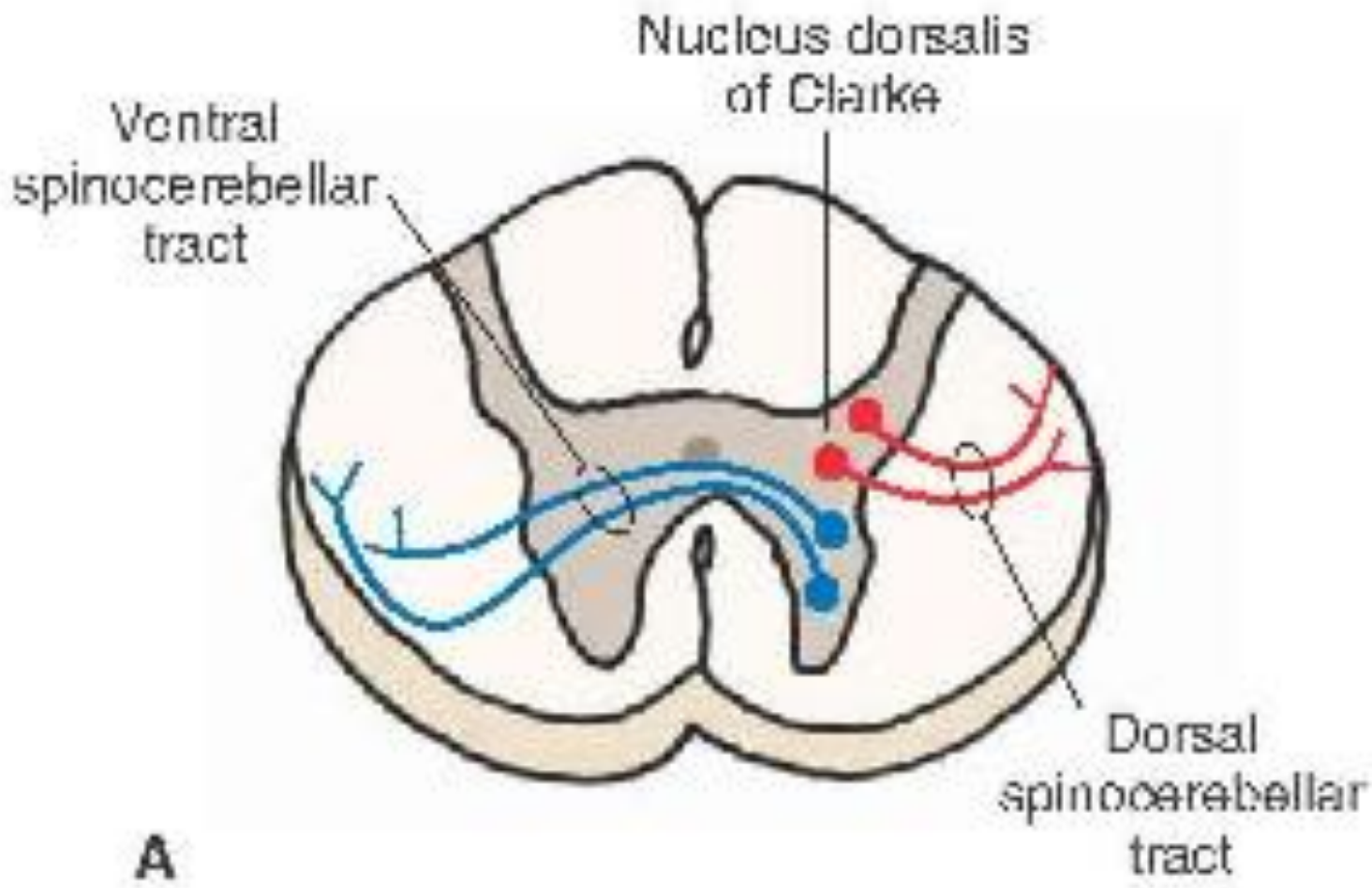
- The fibers emerging from here terminate in the cortex of the cerebellar vermis via the pedunculus cerebellaris inferior.
- It is also connected to the nuclei of the cerebellum through the collateral branches it gives.



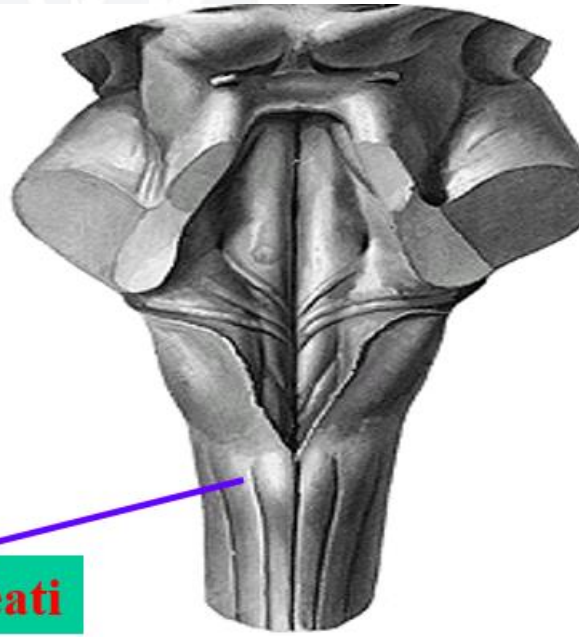

Pedinculus cerebellaris superior
Pedinculus cerebellaris inferior
Tr. spinocerebellaris anterior
Tr. spinocerebellaris posterior

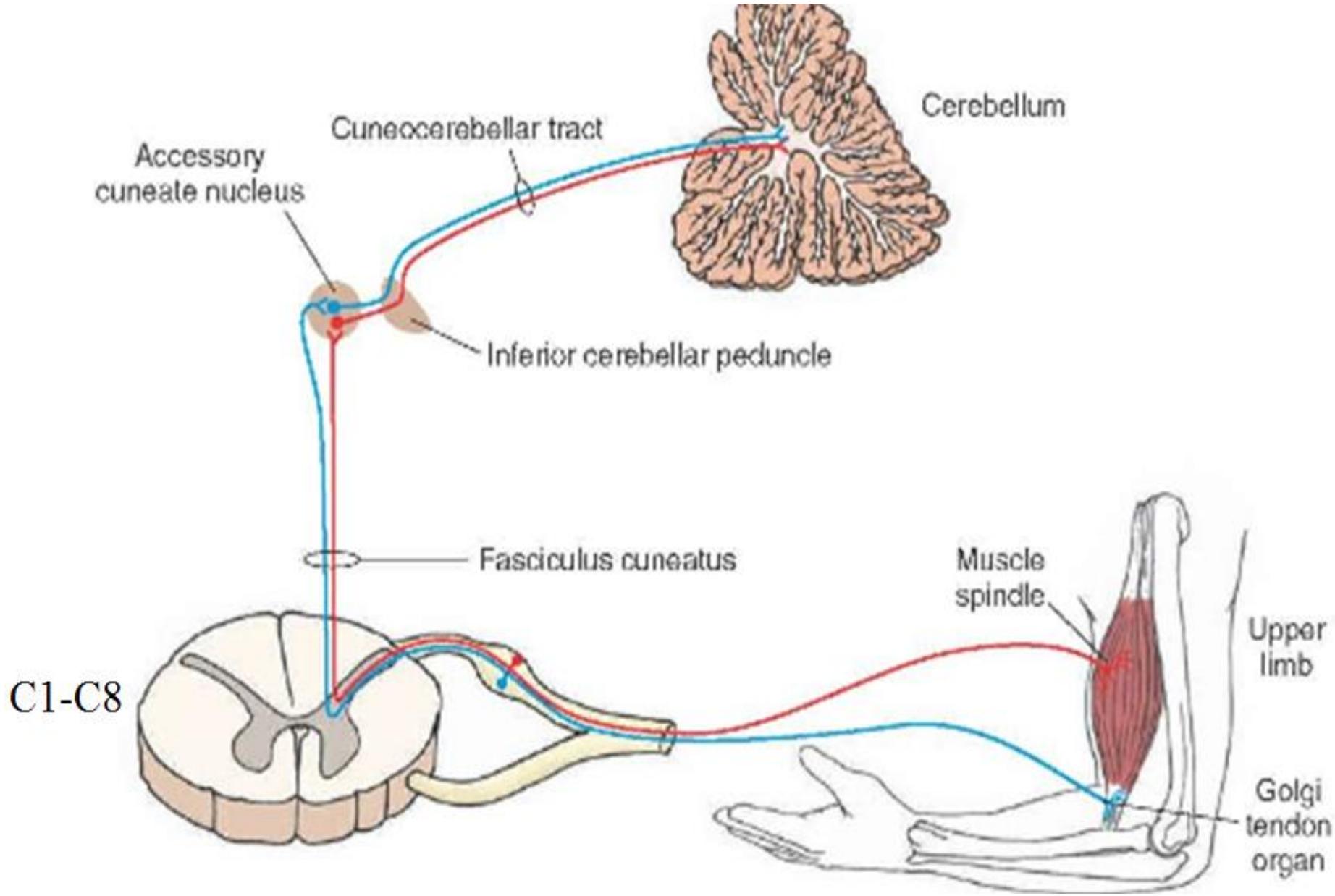

Cerebellum
Inferior cerebellar peduncle
(restiform body)
Posterior
spinocerebellar
tract
C8– L2
Nucleus dorsalis
of Clarke
Muscle
spindle
Golgi
tendon
organ
Lower
limb


Nucleus dorsalis
of Clarke
Ventral
spinocerebellar
tract
Dorsal
spinocerebellar
tract
A

Tr. cuneocerebellaris: Fibrae arcuatae externae posteriores

- Proprioceptive impulses from the neck and upper extremities (where C1-8 is distributed) enter the spinal cord above the level (T1) where the nucleus thoracicus ends. These fibers exchange neurons in the nucleus cuneatus accessorius, located in the posterior-outer part of the nucleus cuneatus.




Cerebellum
Cunecocerebellar tract
Accessory
cuneate nucleus
Inferior cerebellar peduncle
Fasciculus cuneatus
C1-C8
Muscle
spindle
Upper
limb
Golgi
tendon
organ

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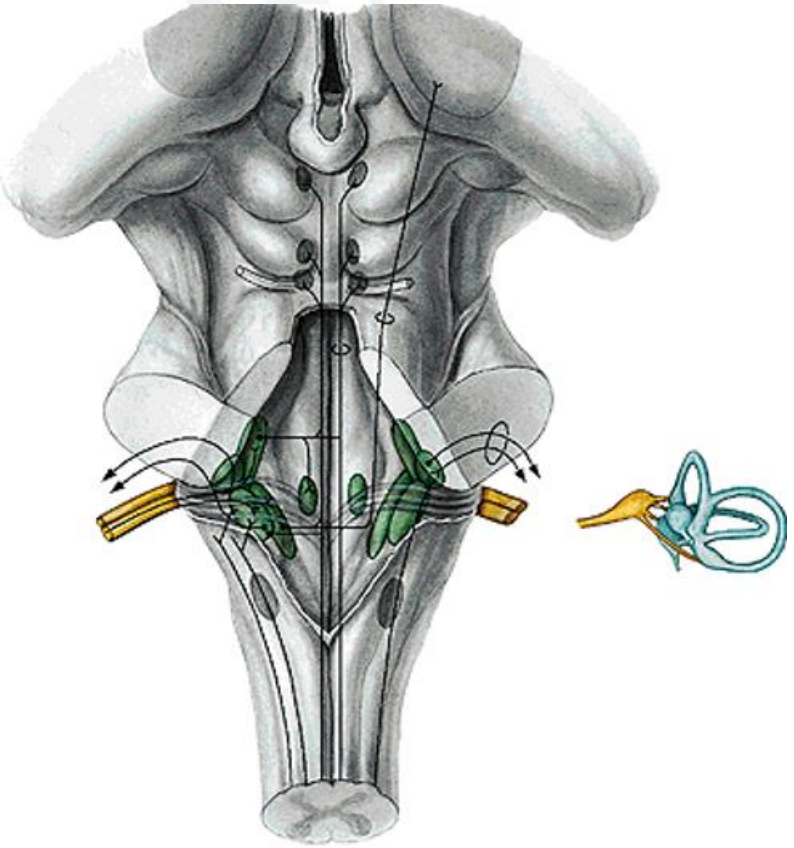
- The fibers emerging from these nuclei form tractus cuneocerebellaris. This pathway passes through the pedunculus cerebellaris inferior and terminates in the vermis cortex of the ipsilateral cerebellar half.
- It also connects with the nuclei of the cerebellum with the collateral branches it gives. This pathway does the same as tractus spinocerebellaris posterior.

Pathways to the cerebellum via N. vestibularis

- All of these fibers originating from the balance organs terminate in the lobus flocculonodularis of the cerebellum.
- Some fibers of N. vestibularis are not cut, and some fibers are nuc. After changing neurons in the vestibularis, it passes through the pedunculus cerebellaris inferior (tr. vestibulocerebellaris) and ente the cerebellar half on the same side.
- All of these fibers from the balance organ go to the lobus flocconodularis.



Efferent pathways of the cerebellum

- All efferent fibers originating from the cerebellum cortex are axons of Purkinje cells.
- Most of these replace neurons in the nuclei of the cerebellum and attach to the nucleus ruber, thalamus, and formatio reticularis.
- Some pass through the nuclei of the cerebellum without interruption and terminate in the nucleus vestibularis lateralis.

Efferent fibers of the cerebellum

Go to;

1-Nuc. vestibularis lat. (tr. cerebellovestibularis)

2-Nuc. ruber (tr. cerebellorubralis)

3-Thalamus (tr. cerebellothalamicus)

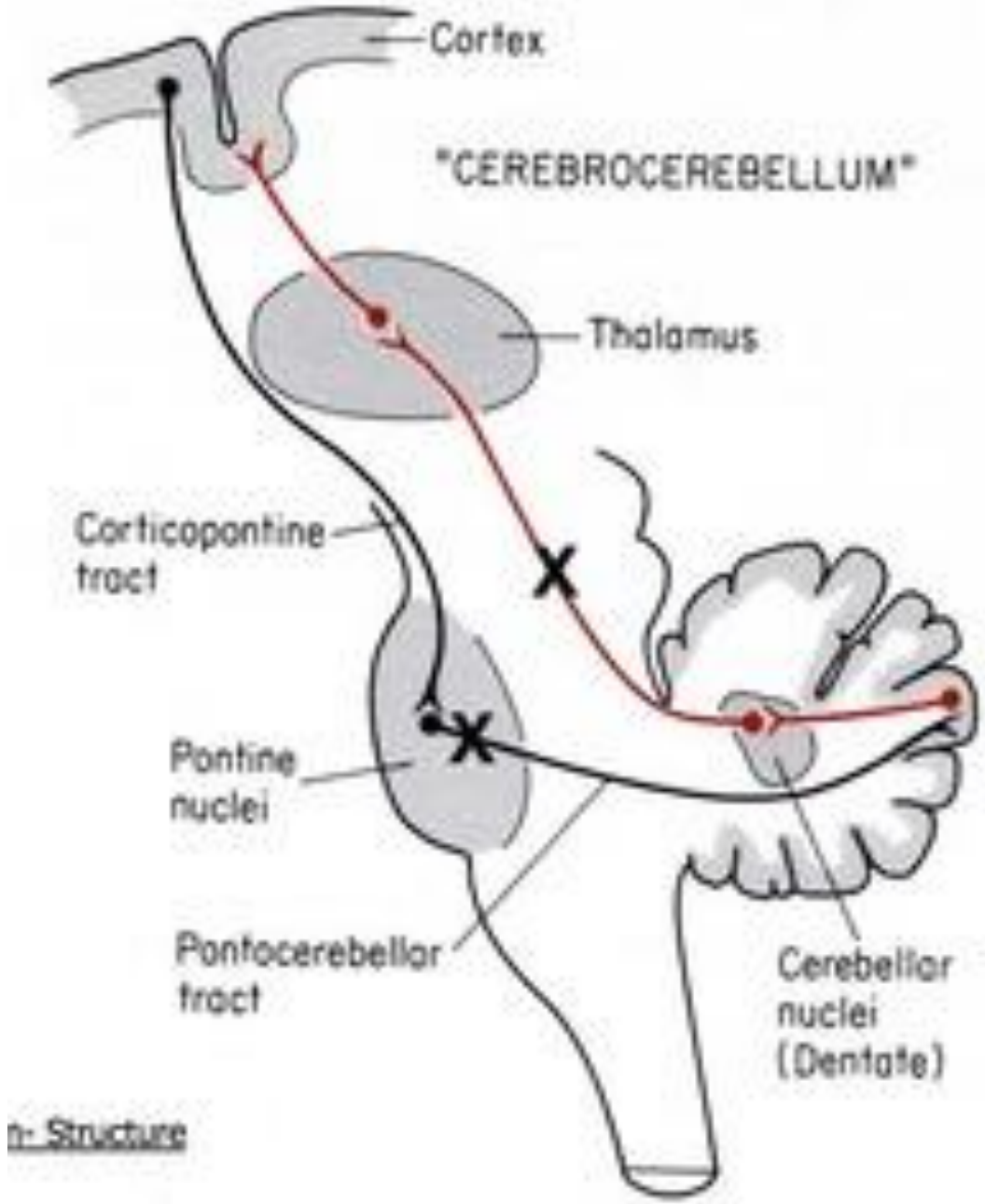
4-Formatio reticularis (tr. cerebelloreticularis)

Tr. cerebellorubralis

- Axons originating from the nucleus globosus and nucleus emboliformis pass through the superior pedunculus cerebellaris.
- After the fibers cross at the midline (decussatio pedunculi cerebellaris superioris), they terminate in the nucleus ruber of the opposite side.
- Starting from the nucleus ruber, the tractus rubrospinalis crosses again (Forel cross) and goes to the anterior horn motor neurons of the spinal cord.
- As the fibers from the nucleus globosus and nucleus emboliformis cross the midline in two places up to the medulla spinalis, they will adjust the tone of the flexor muscles on their side.

Tr. cerebellothalamicus

- Axons originating from the nucleus dentatus leave the cerebellum from the pedunculus cerebellaris superior and cross the midline (decussatio pedunculorum cerebellarium superiorum) and terminate in the nucleus ventralis intermedius (lateralis) of the thalamus nuclei of the opposite side.
- Tractus thalamocorticalis, which emerges from here, passes through the capsula interna and corona radiata and ends in the primary motor area (gyrus precentralis: 4th field).
- Thanks to this connection, the nucleus dentatus affects the cortical motor area of the opposite side and contributes to a more regular movement.


Cortex
"CEREBROCEREBELLUM"
Thalamus
Corticopontine tract
Pontine nuclei
Pontocerebellar tract
Cerebellar nuclei (Dentate)

n- Structure

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- The impulses from the cerebral cortex, on the other hand, connect with the spinal cord via tractus corticospinalis and with the motor neurons of the cranial nerves via tractus corticonuclearis.
- Tractus corticospinalis crosses the midline and passes to the opposite side in the segment where it ends in the bulbus and the rest in the spinal cord.
- Thus, the path from the nucleus dentatus to the thalamus and cerebral cortex, and then to the spinal cord by turning down, crosses the midline twice.
- Therefore, the nucleus dentatus controls the motor activity of the skeletal muscles on its side.

Tr. cerebellovestibularis

- Axons originating from the nucleus fastigii leave the cerebellum from the pedunculus cerebellaris inferior and terminate in the nucleus vestibularis lateralis on either side.
- Some fibers originating from Purkinje cells in the cerebellar cortex terminate directly in the nucleus vestibularis lateralis.
- Starting from the nucleus vestibularis lateralis, tractus vestibulospinalis connects with the anterior horn motor cells of the ipsilateral medulla spinalis.
- Thus, the nucleus fastigii exerts a facilitating effect on the extensor skeletal muscles of the same side.

Tr. cerebelloreticularis

- Fibers originating from the nucleus fastigii of the cerebellum leave the cerebellum from the pedunculus cerebellaris superior and attach to neurons in the formatio reticularis of the same side.
- Fibers starting from here enter the anterior horn motor cells of the spinal cord as tractus reticulospinalis.
- **Thus, the motor activity of the spinal cord is controlled.**

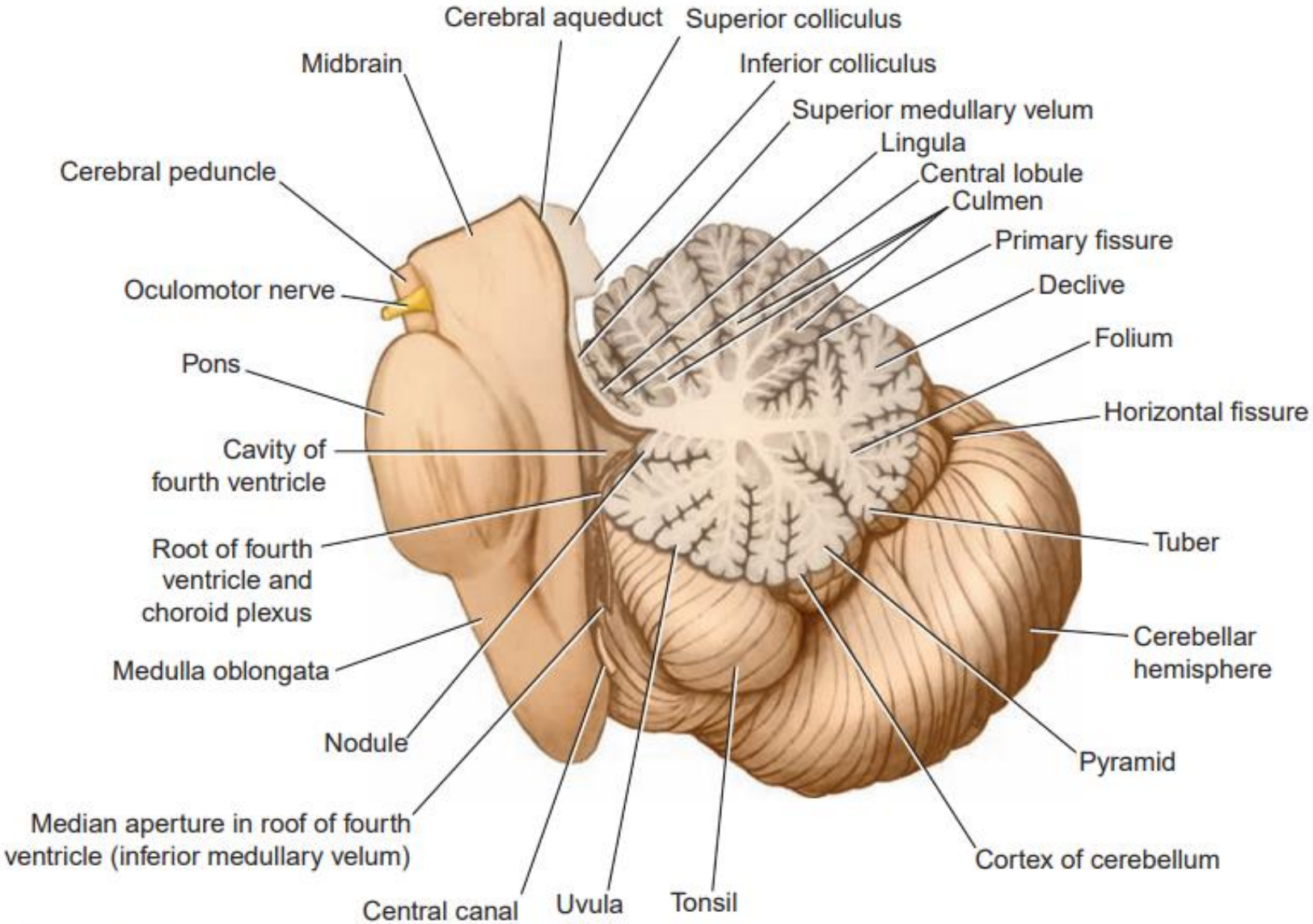

Figure 6-1 Sagittal section through the brainstem and the vermis of the cerebellum.

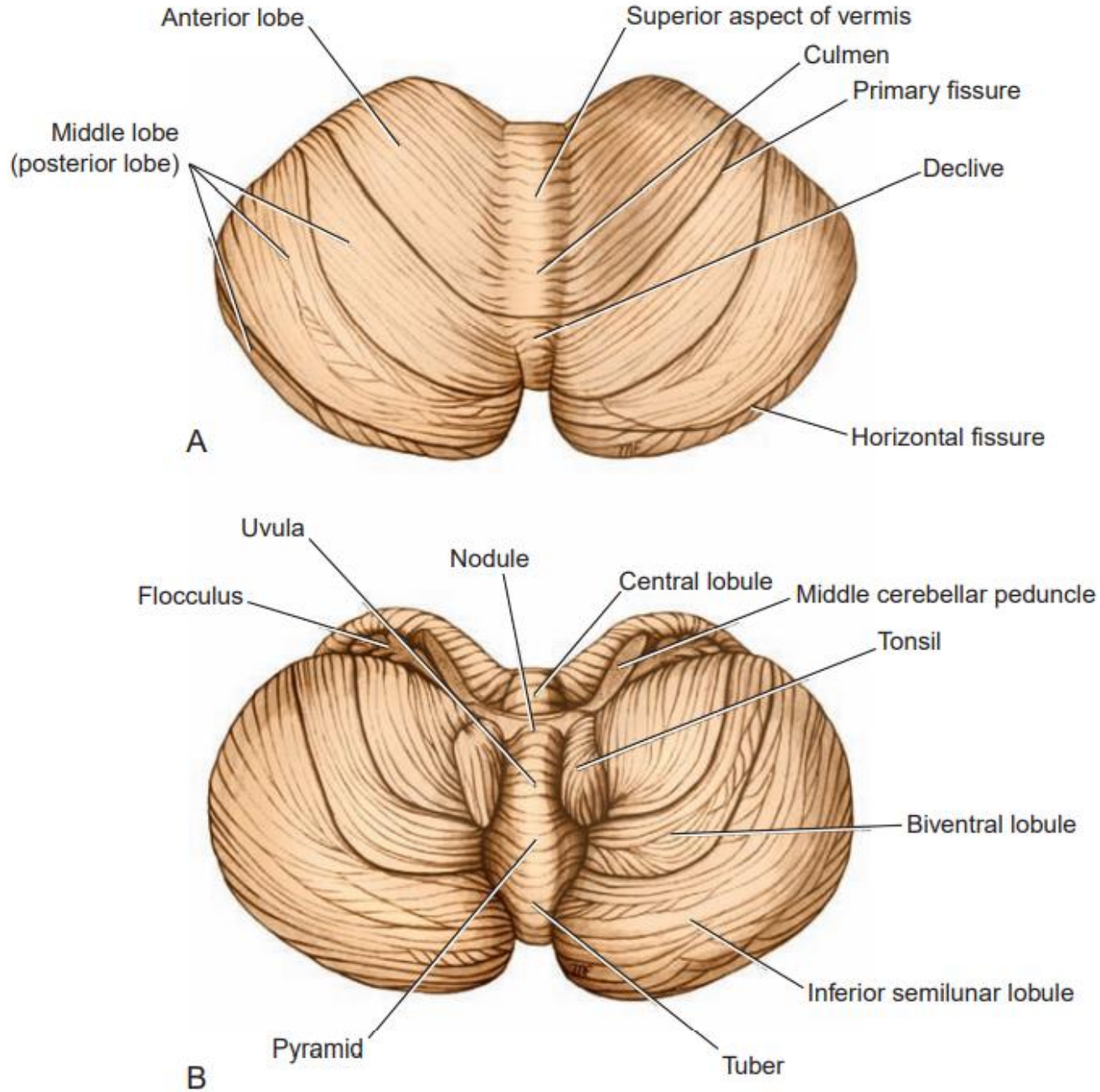

Figure 6-2 The cerebellum. **A:** Superior view. **B:** Inferior view.

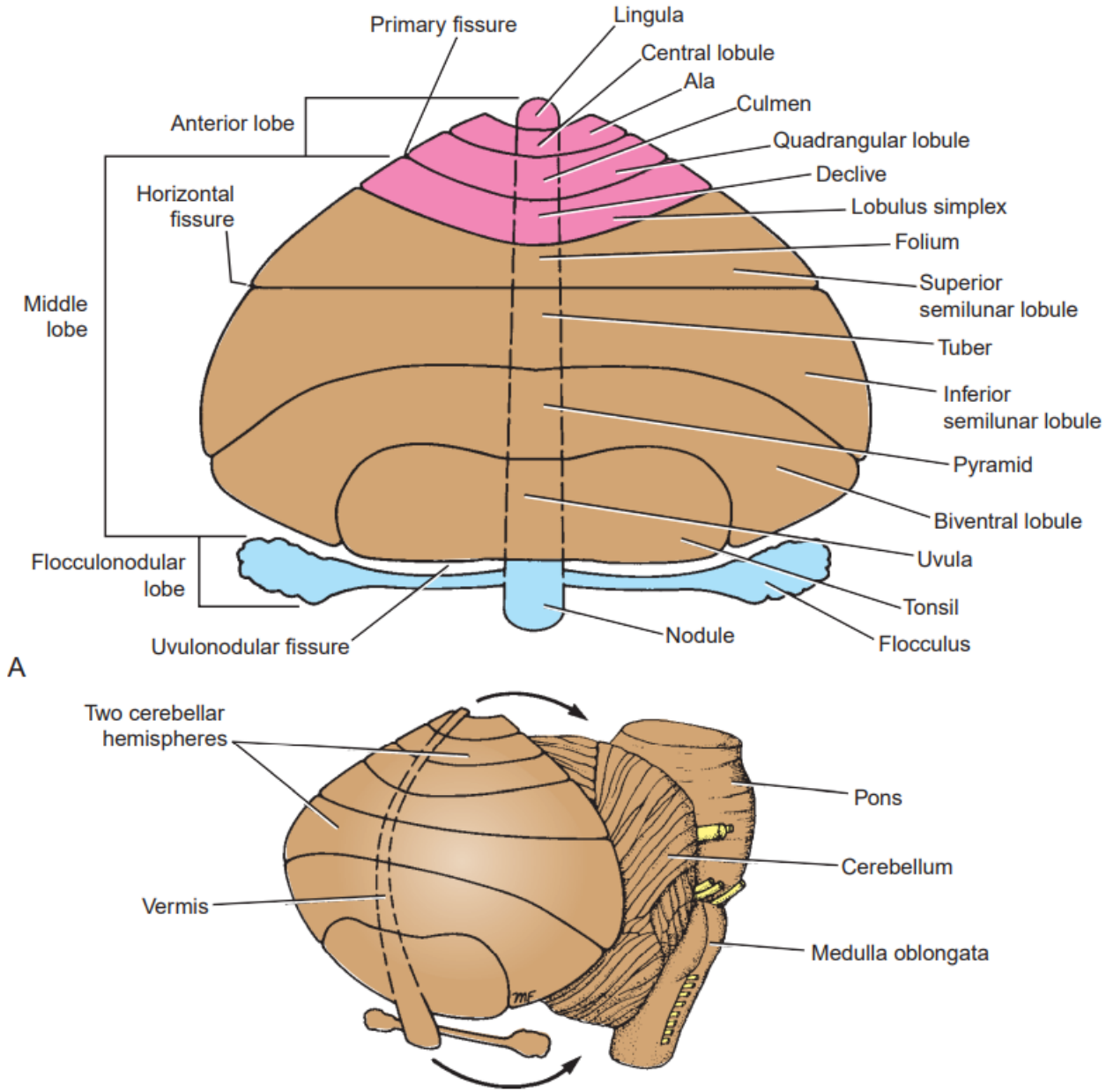

Figure 6-3 **A:** Flattened view of the cerebellar cortex showing the main cerebellar lobes, lobules, and fissures. **B:** Relationship between the diagram in (**A**) and the cerebellum.

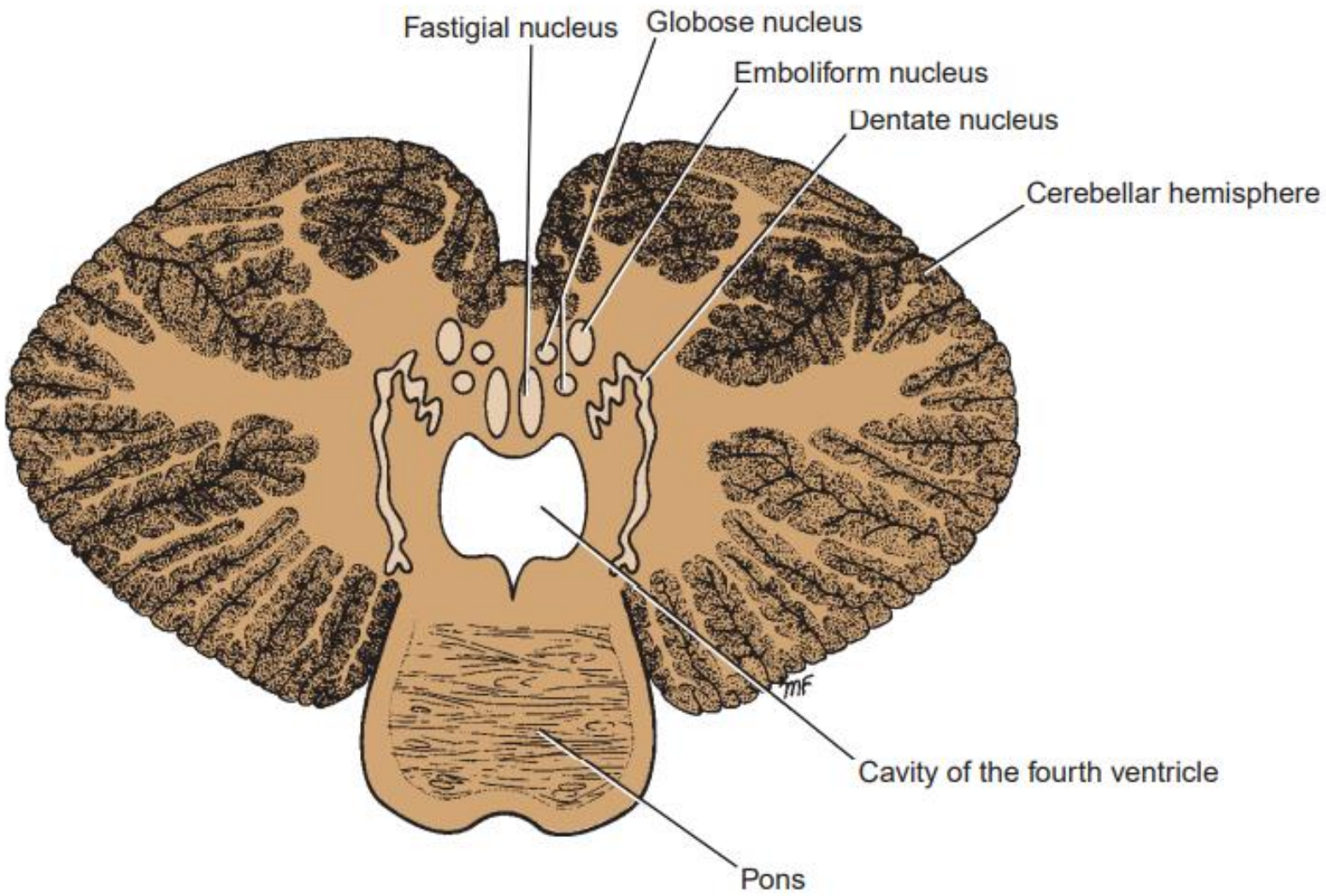

Figure 6-7 Position of the intracerebellar nuclei.

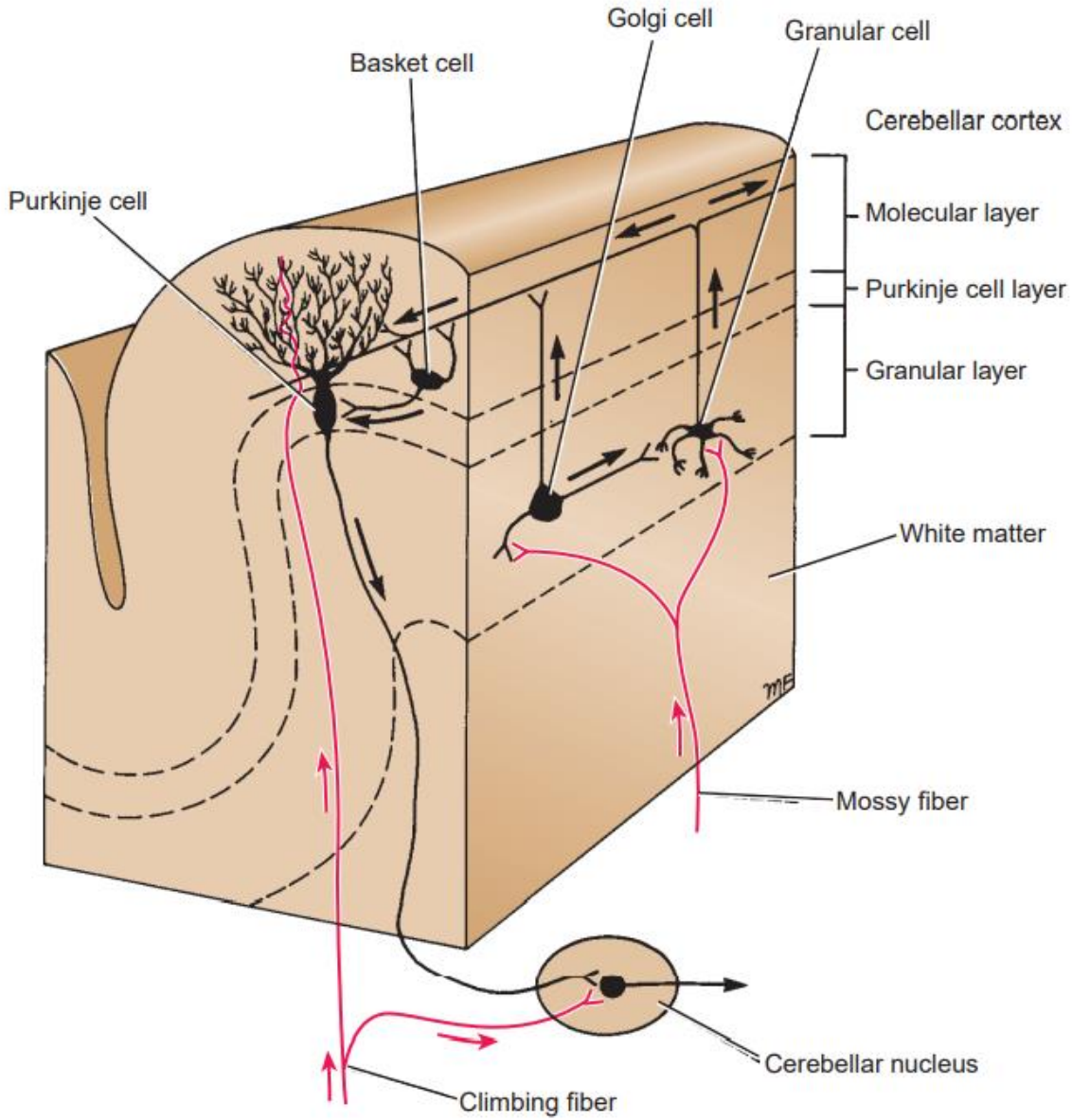

Figure 6-8 Functional organization of the cerebellar cortex. The *arrows* indicate the direction taken by the nervous impulses.

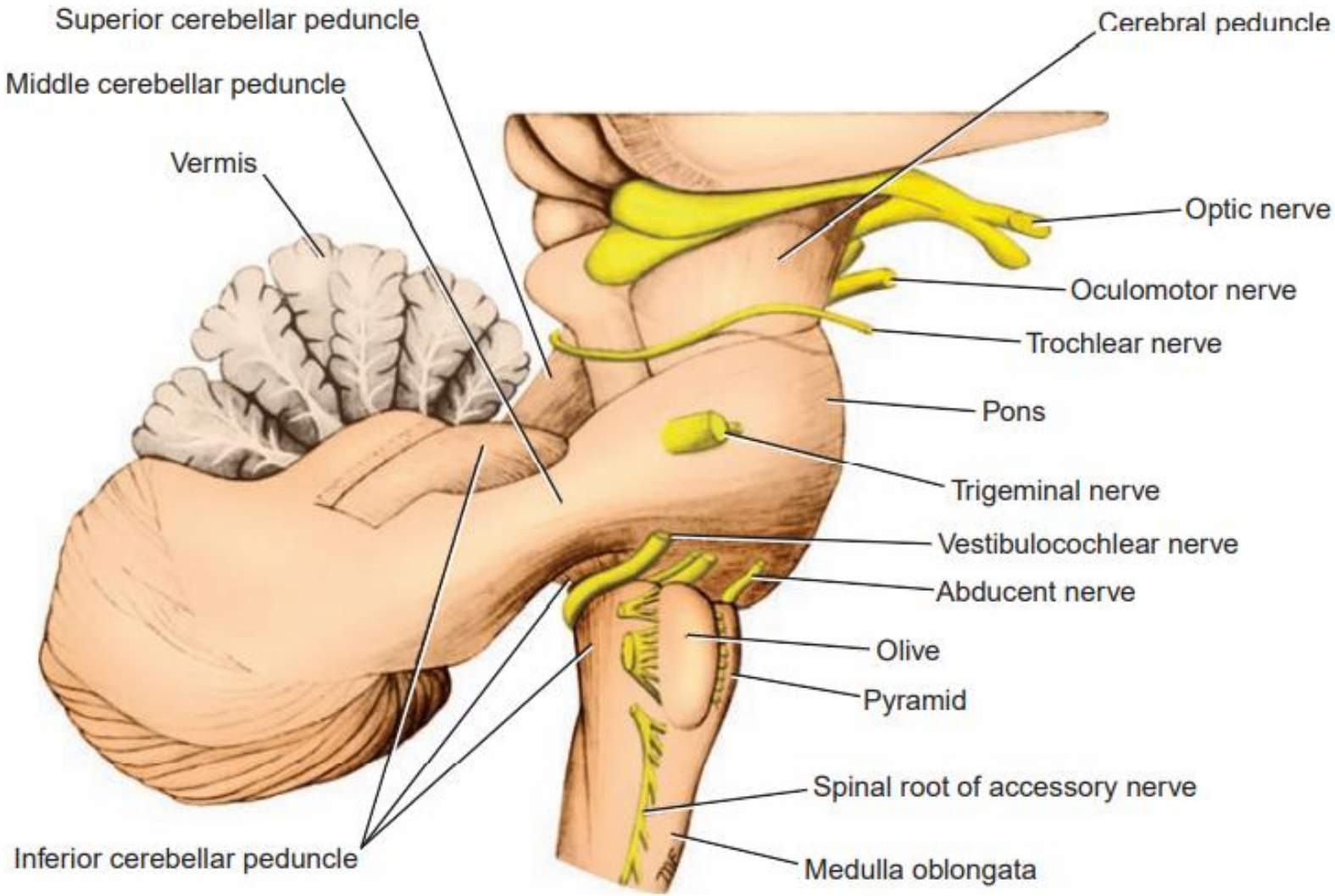

Figure 6-9 Three cerebellar peduncles connecting the cerebellum to the rest of the central nervous system.

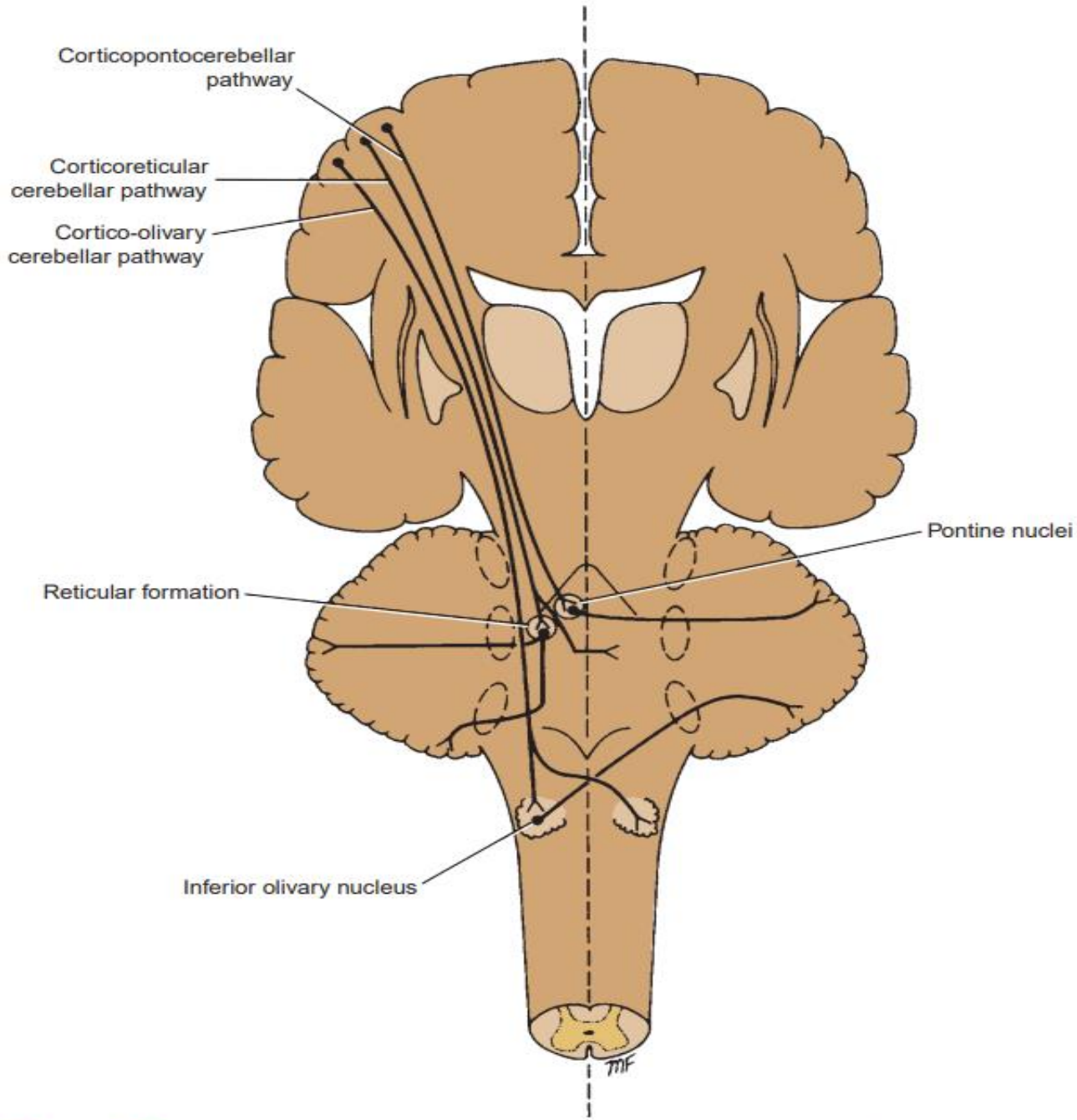

Figure 6-10 Cerebellar afferent fibers from the cerebral cortex. The cerebellar peduncles are shown as *ovoid dotted lines*.

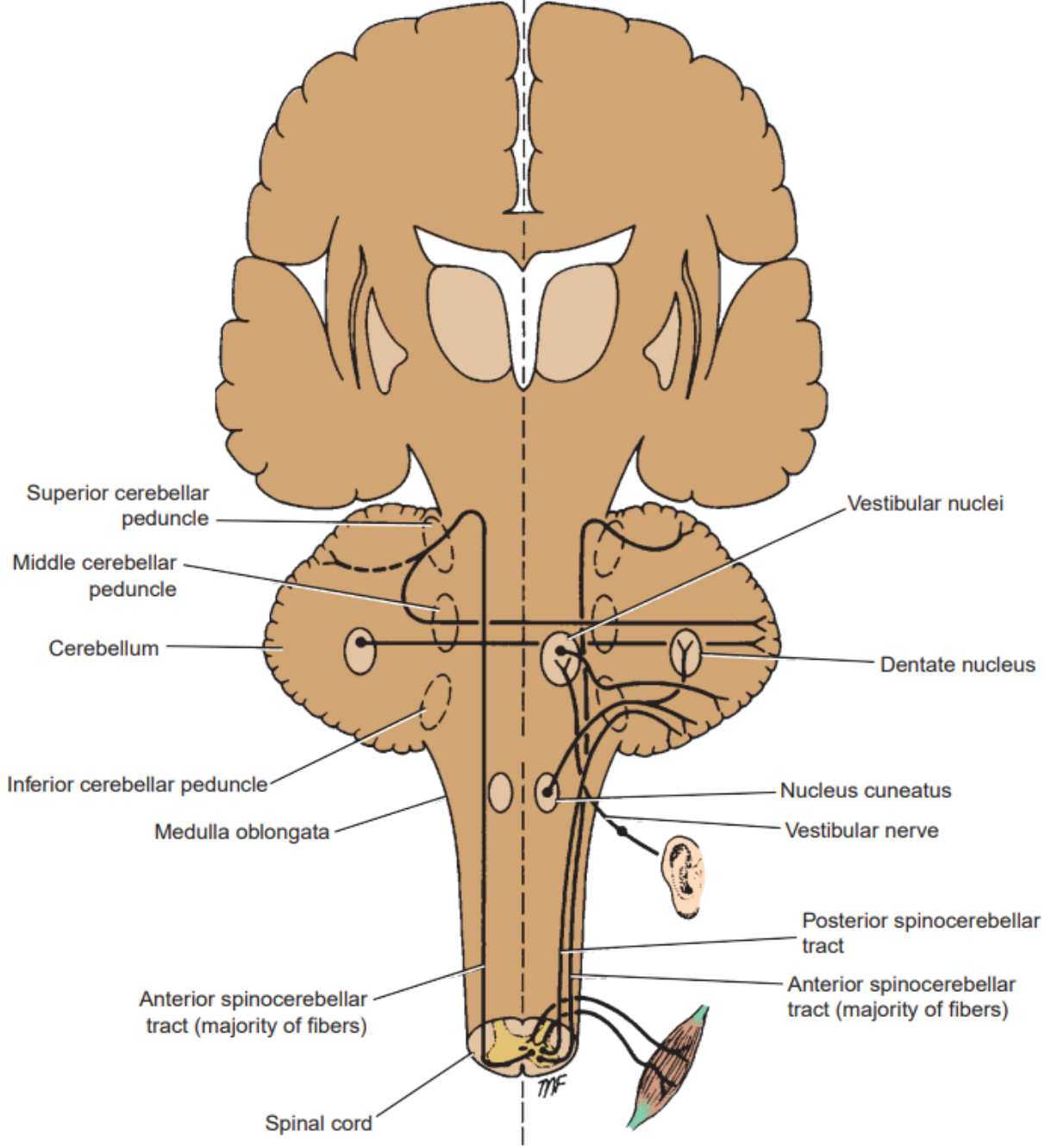

Figure 6-11 Cerebellar afferent fibers from the spinal cord and internal ear. The cerebellar peduncles are shown as *ovoid dotted lines*.

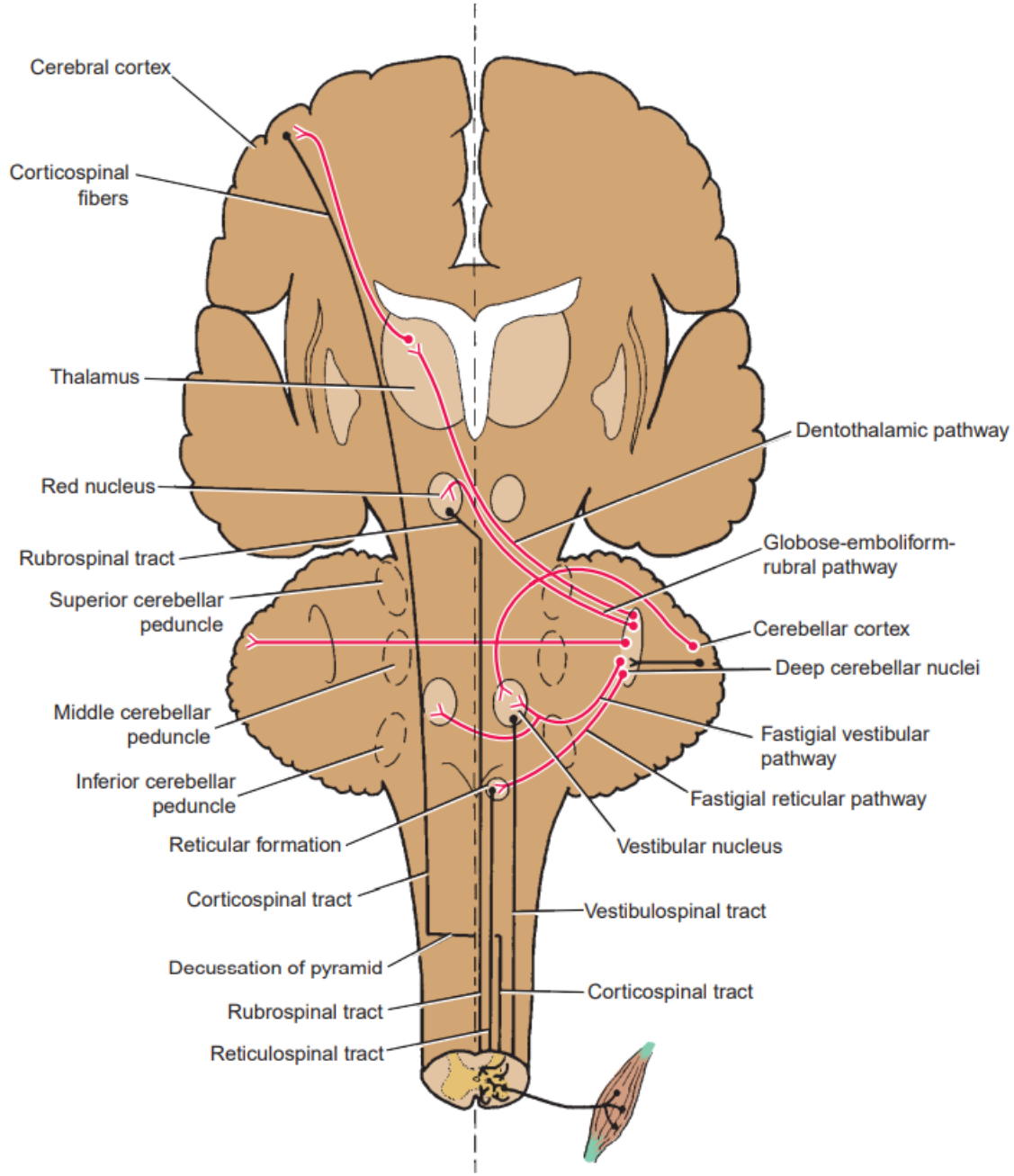

Figure 6-12 Cerebellar efferent fibers. The cerebellar peduncles are shown as *ovoid dotted lines*.

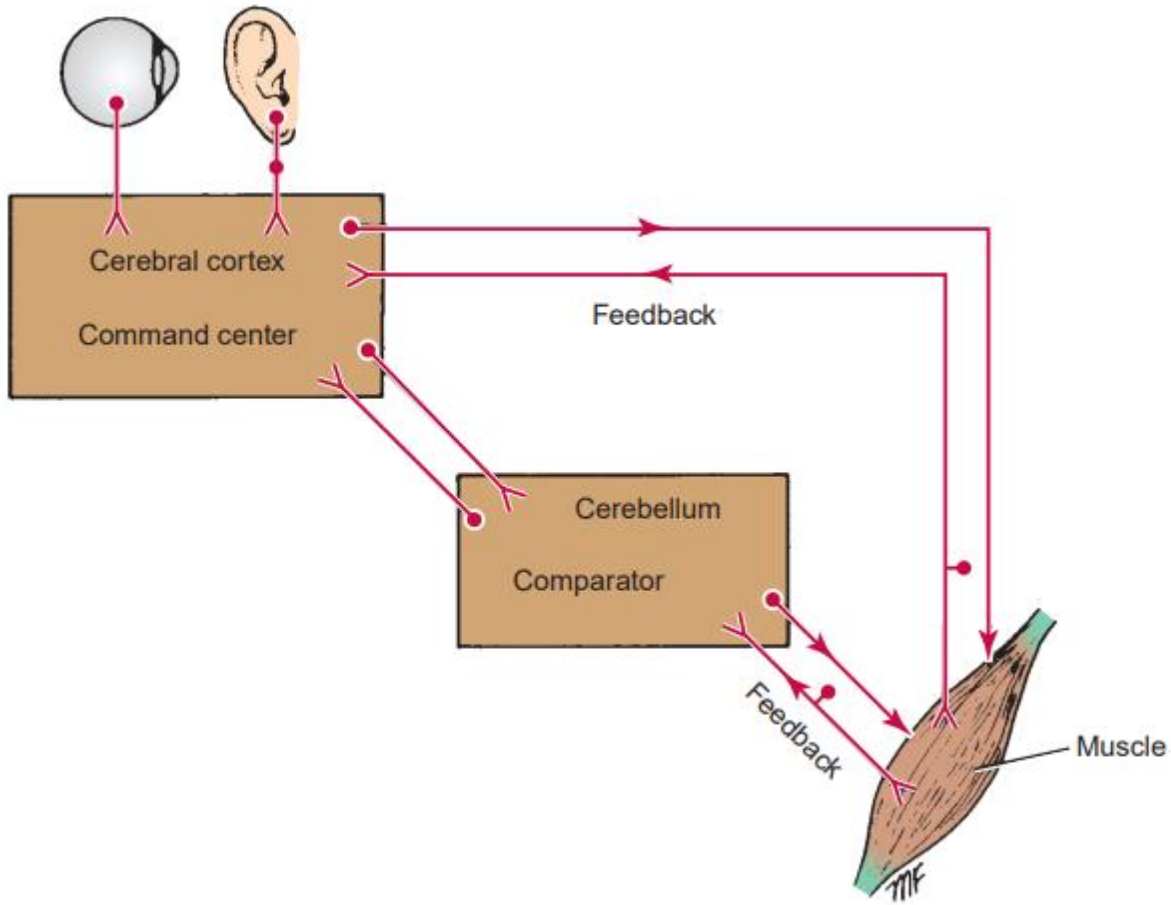

Figure 6-13 Cerebellum serving as a comparator.

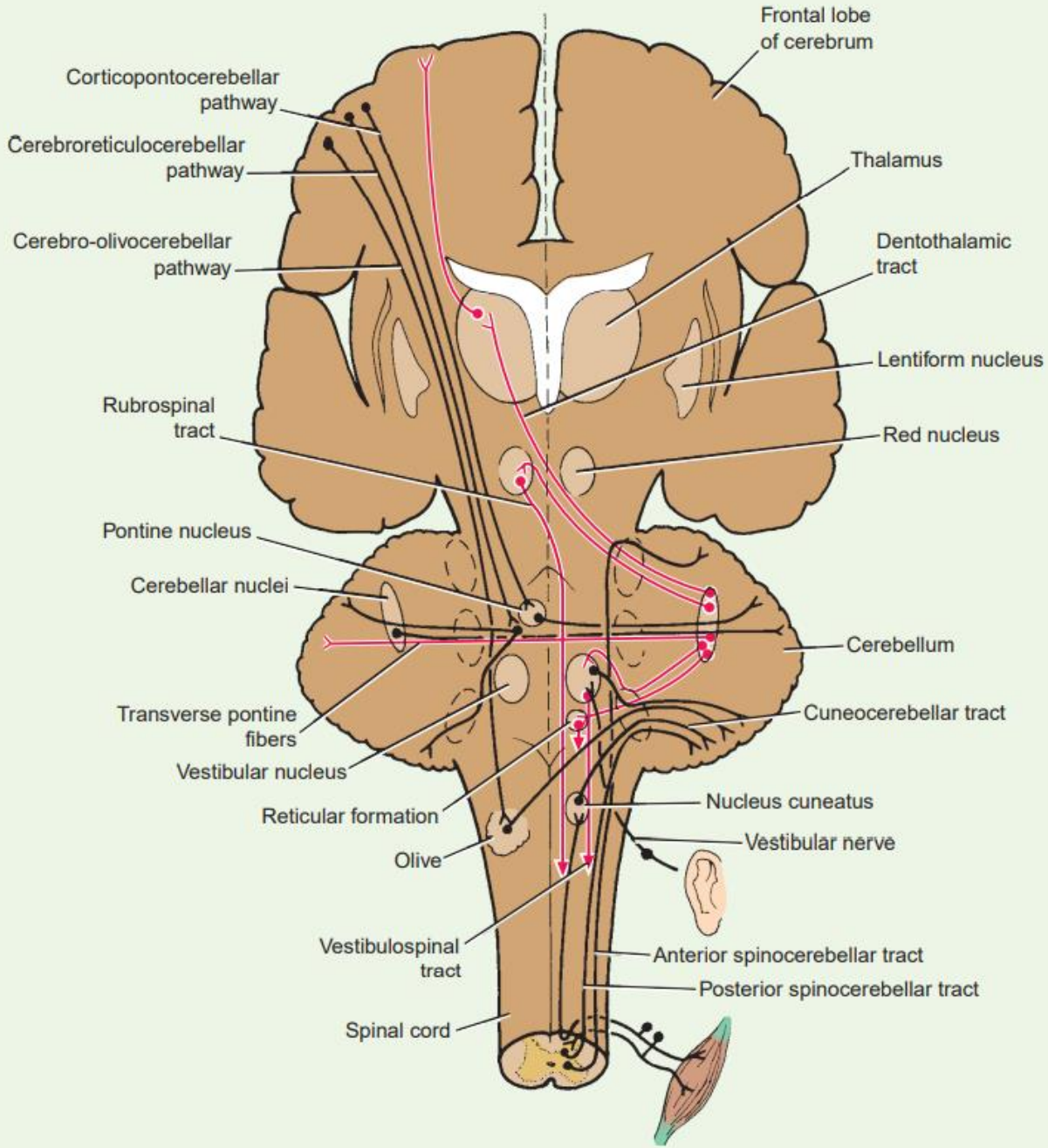

Figure 6-14 Some of the main connections of the cerebellum. The cerebellar peduncles are shown as *ovoid dashed lines*.

Table 6-1 The Afferent Cerebellar Pathways

Pathway	Function	Origin	Destination
Corticopontocerebellar	Conveys control from cerebral cortex	Frontal, parietal, temporal, and occipital lobes	Via pontine nuclei and mossy fibers to cerebellar cortex
Cerebro-olivocerebellar	Conveys control from cerebral cortex	Frontal, parietal, temporal, and occipital lobes	Via inferior olivary nuclei and climbing fibers to cerebellar cortex
Cerebroreticulocerebellar	Conveys control from cerebral cortex	Sensorimotor areas	Via reticular formation
Anterior spinocerebellar	Conveys information from muscles and joints	Muscle spindles, tendon organs, and joint receptors	Via mossy fibers to cerebellar cortex
Posterior spinocerebellar	Conveys information from muscles and joints	Muscle spindles, tendon organs, and joint receptors	Via mossy fibers to cerebellar cortex
Cuneocerebellar	Conveys information from muscles and joints of upper limb	Muscle spindles, tendon organs, and joint receptors	Via mossy fibers to cerebellar cortex
Vestibular nerve	Conveys information of head position and movement	Utricle, saccule, and semicircular canals	Via mossy fibers to cortex of flocculonodular lobe
Other afferents	Conveys information from midbrain	Red nucleus, tectum	Cerebellar cortex

Table 6-2 The Efferent Cerebellar Pathways[a]

Pathway	Function	Origin	Destination
Globose-emboliform-rubral	Influences ipsilateral motor activity	Globose and emboliform nuclei	To contralateral red nucleus, then via crossed rubrospinal tract to ipsilateral motor neurons in spinal cord
Dentothalamic	Influences ipsilateral motor activity	Dentate nucleus	To contralateral ventrolateral nucleus of thalamus, then to contralateral motor cerebral cortex; corticospinal tract crosses midline and controls ipsilateral motor neurons in spinal cord
Fastigial vestibular	Influences ipsilateral extensor muscle tone	Fastigial nucleus	Mainly to ipsilateral and to contralateral lateral vestibular nuclei; vestibulospinal tract to ipsilateral motor neurons in spinal cord
Fastigial reticular	Influences ipsilateral muscle tone	Fastigial nucleus	To neurons of reticular formation; reticulospinal tract to ipsilateral motor neurons to spinal cord

[a]Note that each cerebellar hemisphere influences the voluntary muscle tone on the same side of the body.

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