CEREBELLUM AND ATAXIAS

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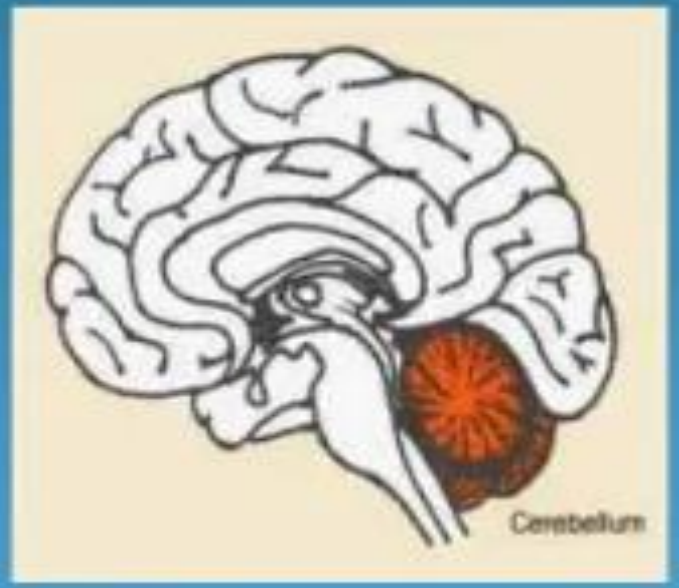
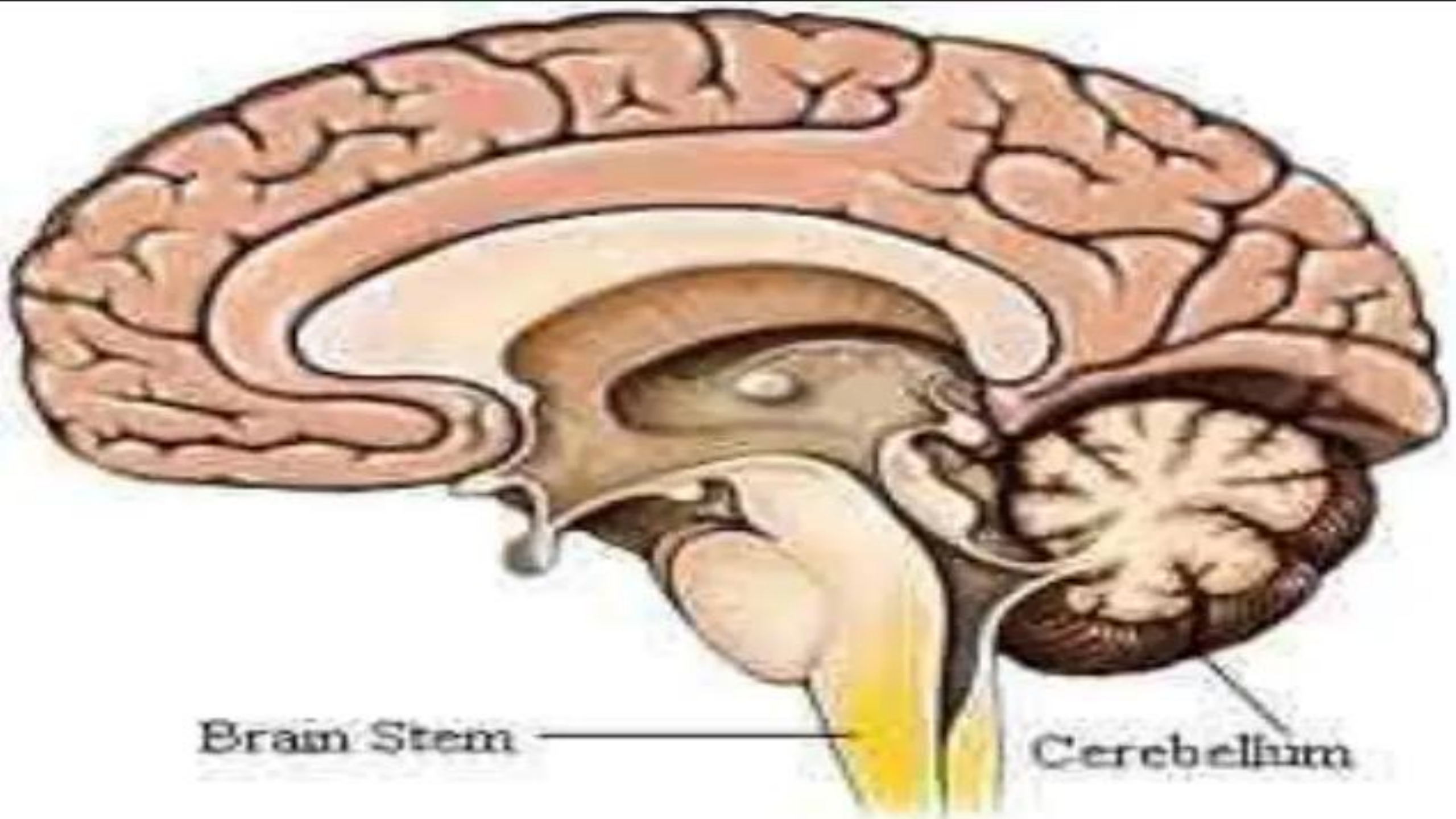
CEREBELLUM




Brain Stem
Cerebellum

CEREBELLUM

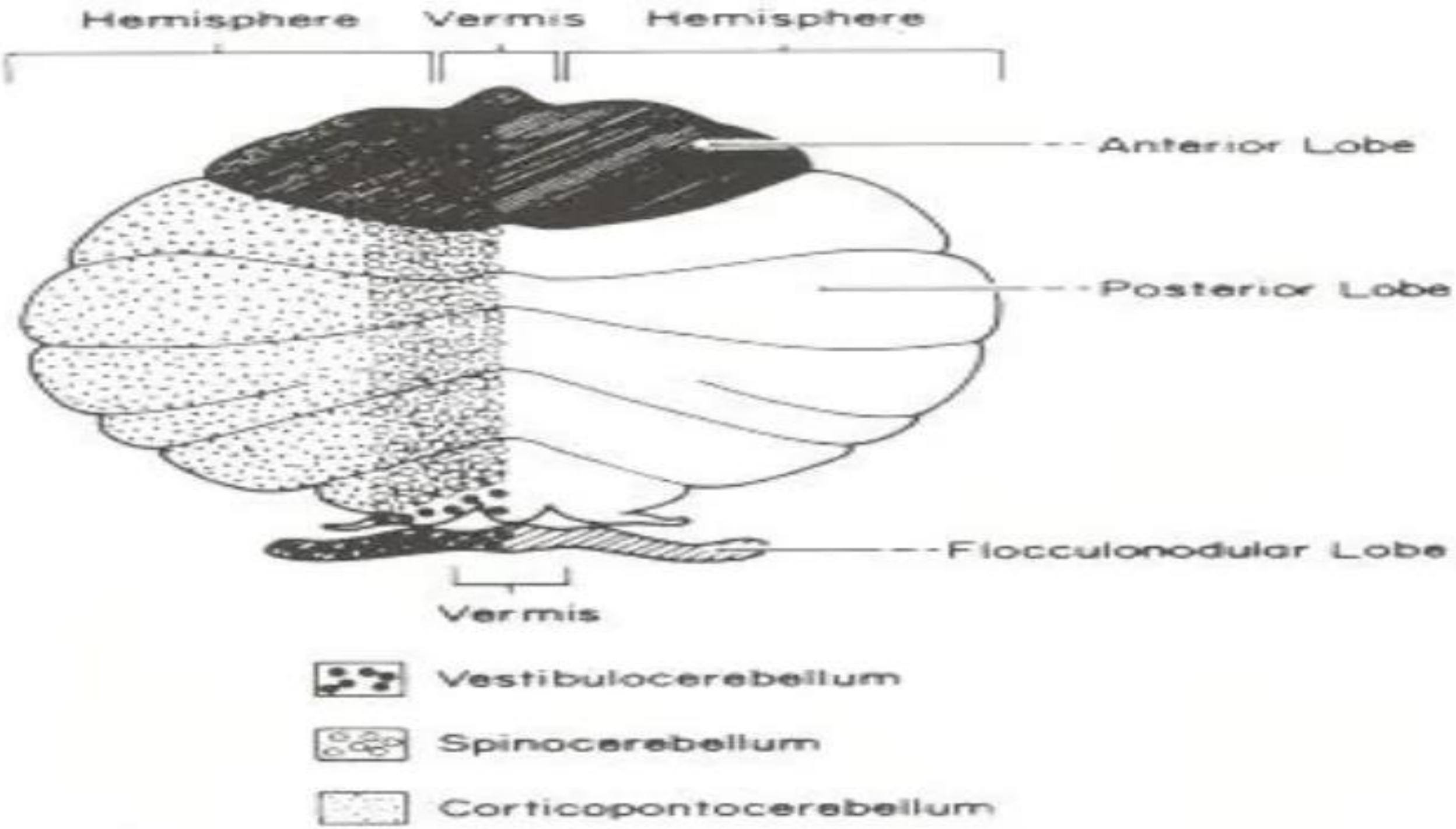
1) Vermis and hemispheres, and 2) three lobes.

Vermis and hemispheres: The midline area is called the vermis, because it resembles a worm. Spreading out on either side from the vermis are the cerebellar hemispheres.

Three lobes: The cerebellum is divided into ***three*** lobes by ***two*** fissures.

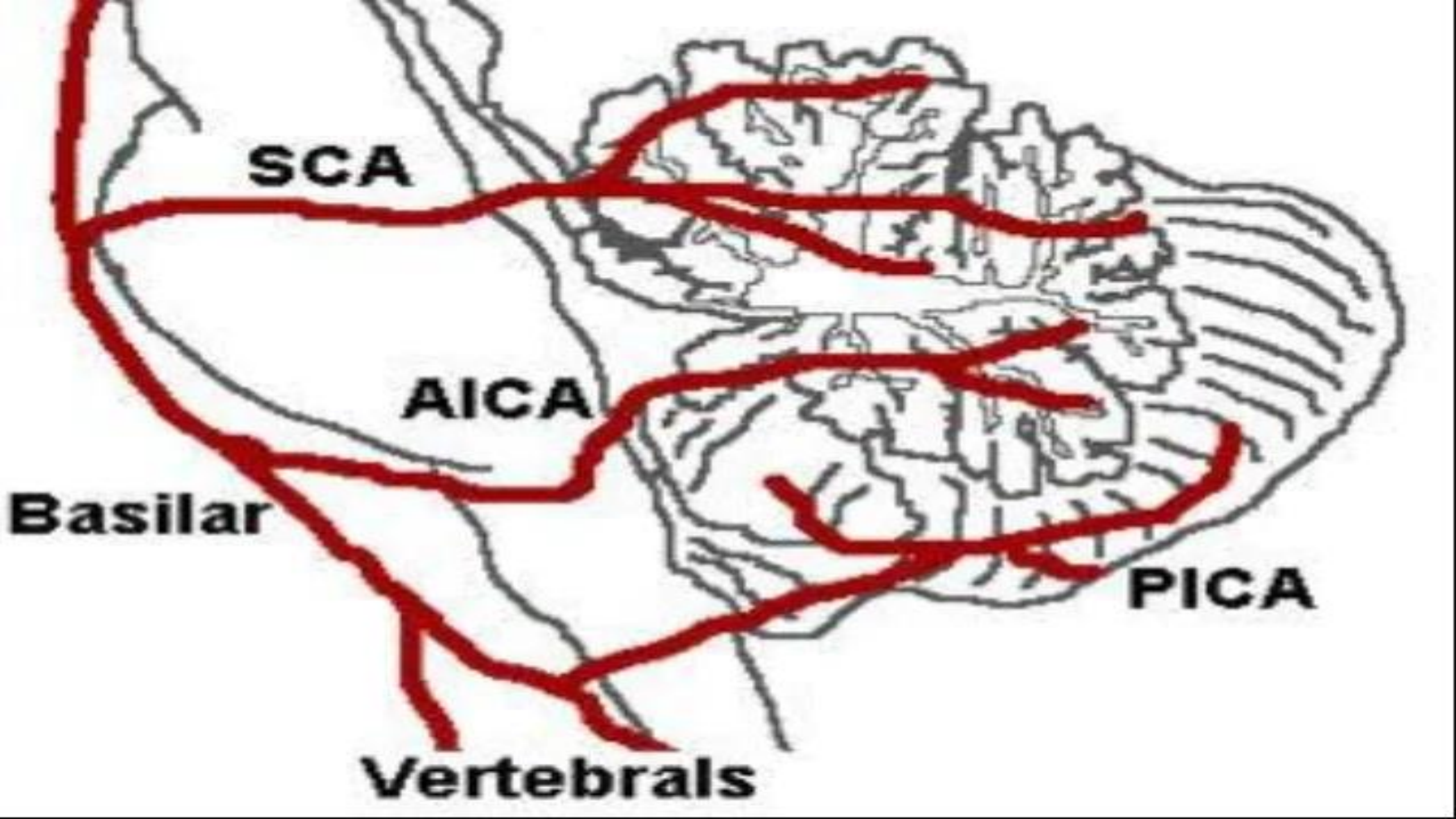
The posterolateral fissure separates the flocculonodular lobe from the rest of the cerebellum that is further divided by the primary fissure into an ***anterior lobe*** and a ***posterior lobe***. The anterior lobe is rostral to the primary fissure while the posterior lobe, the largest cerebellar lobe, is caudal to the primary fissure.

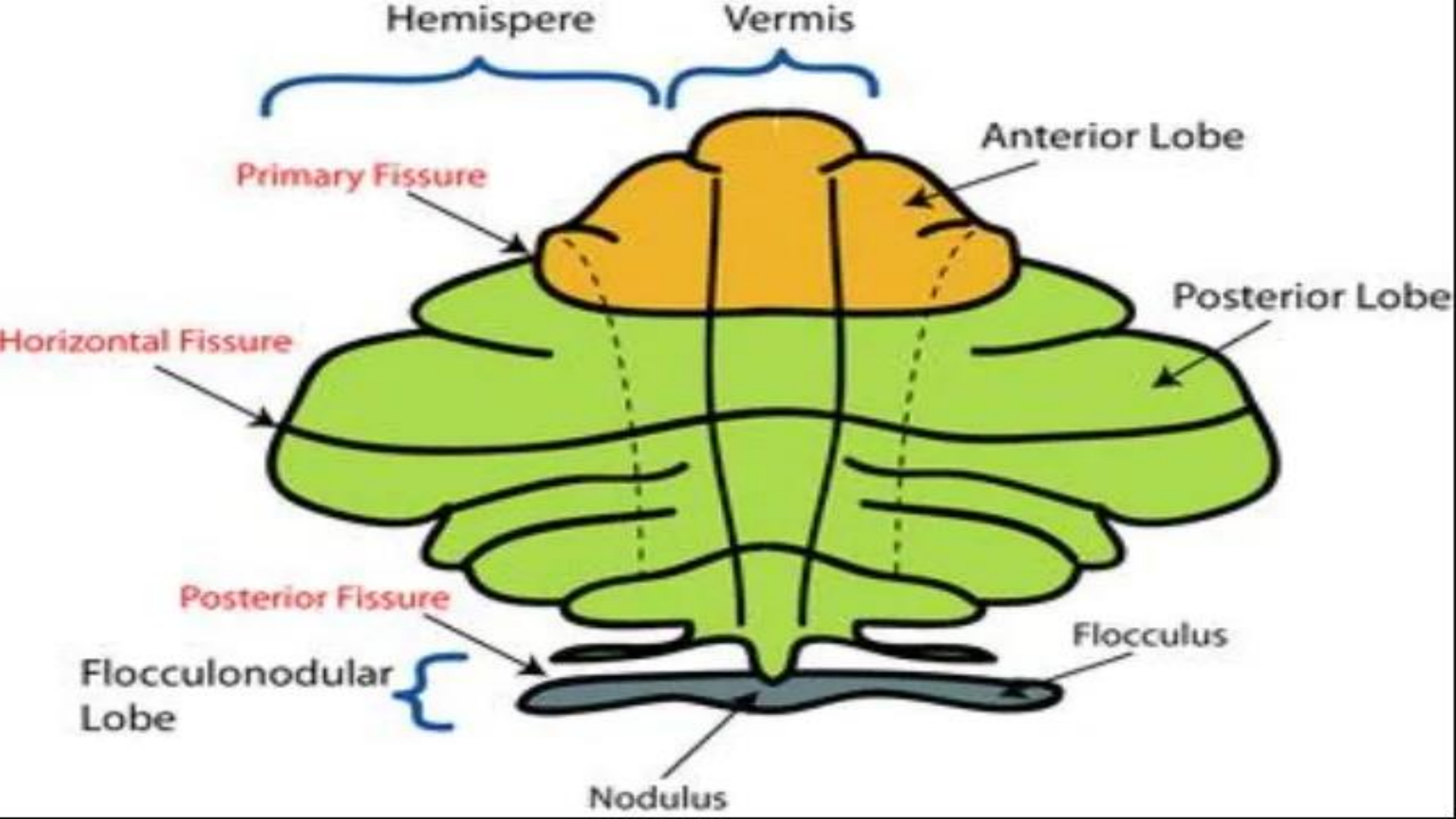
The flocculonodular lobe is composed of the small nodulus ,which is part of the midline vermis, and the left and right flocculi, which are small lobules of the hemispheres.


Hemisphere
Vermis
Hemisphere
Anterior Lobe
Posterior Lobe
Flocculonodular Lobe
Vermis
Vestibulocerebellum
Spinocerebellum
Corticopontocerebellum

Blood Supply: the cerebellum is supplied by:

- Superior cerebellar artery (branch of the basilar artery).
- Anterior inferior cerebellar artery (branch of the basilar artery).
- Posterior inferior cerebellar artery (branch of the vertebral artery).

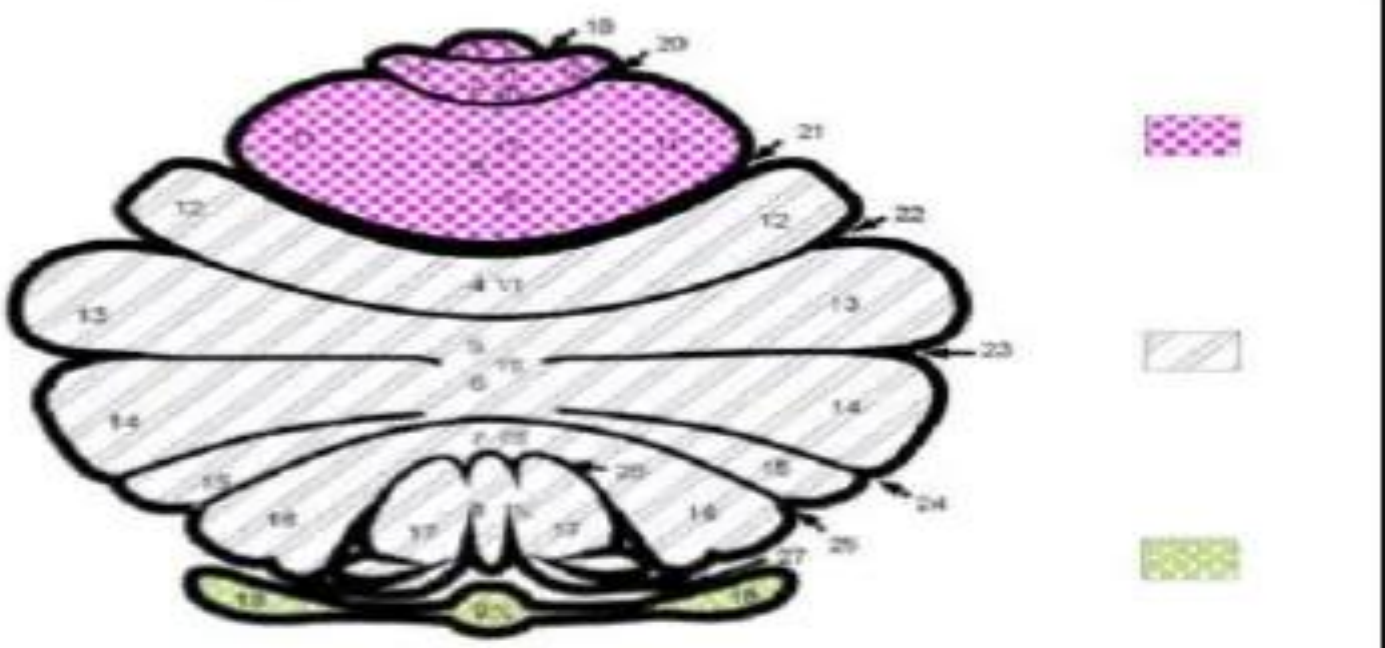

SCA
AICA
Basilar
PICA
Vertebrals


Hemispere
Vermis
Anterior Lobe
Primary Fissure
Posterior Lobe
Horizontal Fissure
Posterior Fissure
Flocculus
Flocculonodular Lobe
Nodulus

Cerebellar divisions

- ARCHICEREBELLUM=the flocculonodular lobe = vestibulocerebellum = its primary connections are with the vestibular nuclei,

- Responsible for equilibrium



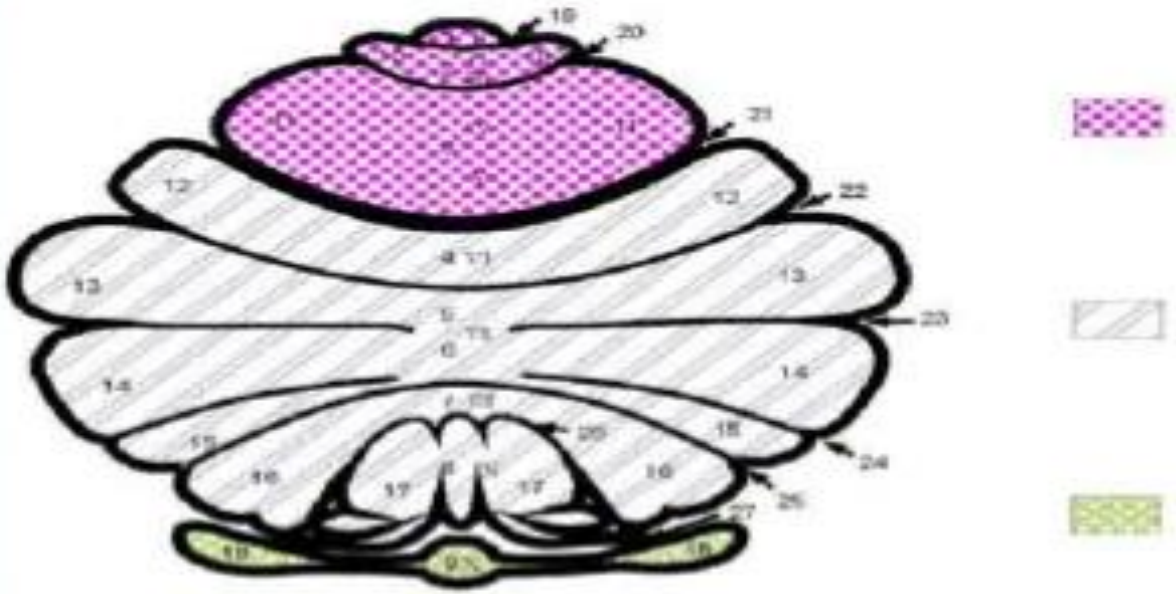
Cerebellar divisions

PALEOCEREBELLUM= anterior lobe=spinocerebellum

- It receives proprioception input from the dorsal columns of the spinal cord (including the spinocerebellar tract)
- It sends fibres to deep cerebellar nuclei that→both the cerebral cortex and the brain stem→ providing modulation of descending

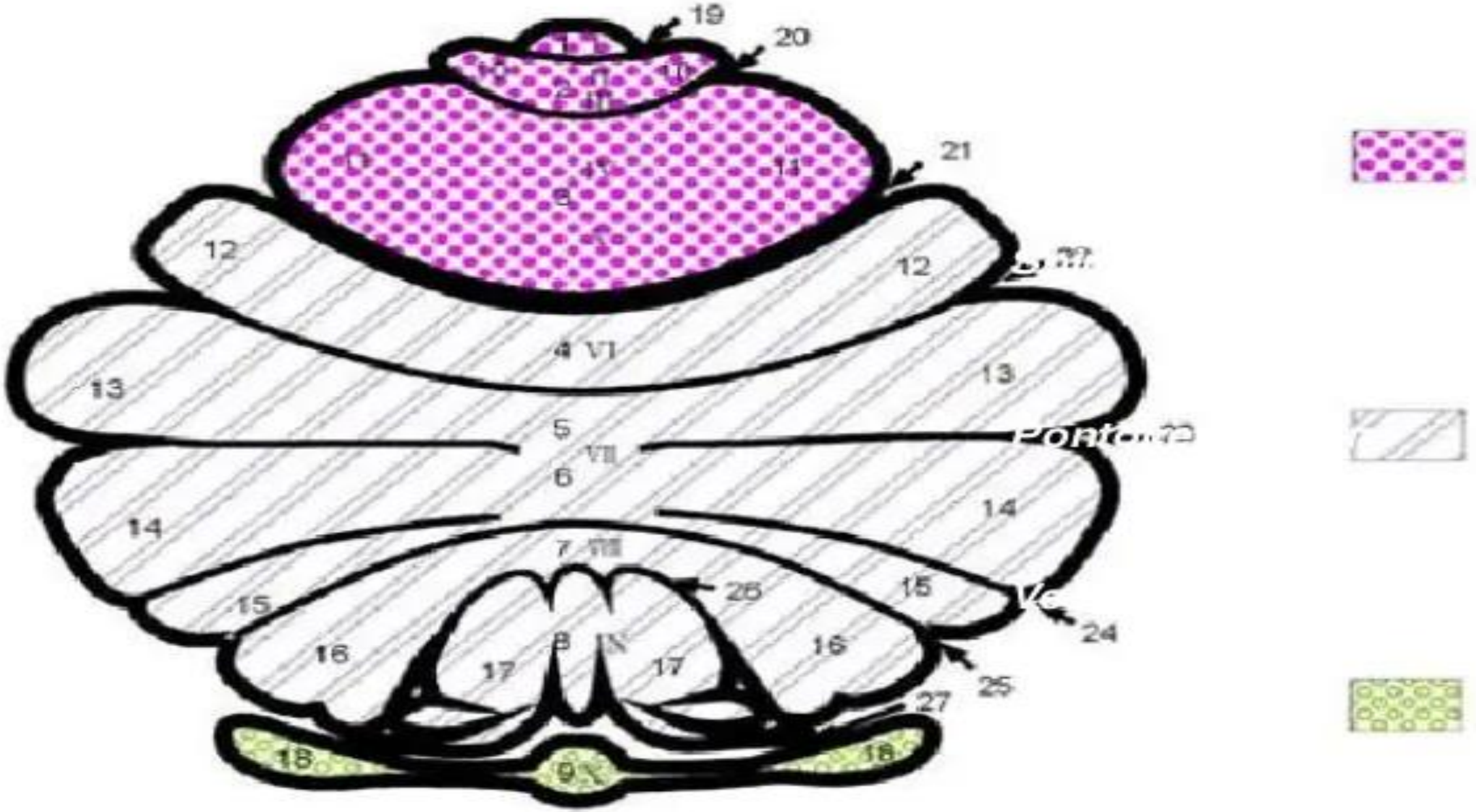
motor systems

→ mainenance of tone



Cerebellar divisions

- **NEOCEREBELLUM = The lateral zone = the cerebrocerebellum**
- It receives input exclusively from the cerebral cortex (especially the parietal lobe) via the pontine nuclei (forming cortico-ponto-cerebellar pathways).
- It sends output mainly to the ventrolateral thalamus → premotor cortex and primary motor area of the cerebral cortex) and to the red nucleus→ providing modulation of descending motor systems→ **Coordination of movement**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VII
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7 VIII
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Cerebellum

Classifications

Classification by Phylogenetic and Ontogenic Development

- Archicerebellum
- Paleocerebllum
- Neocerebellum

Classification by Afferent Connection

- Vestibulocerebellum
- Spinocerebellum
- Pontocerebellum

Classification by Efferent Connection

- Vermis
- Paravermal Region
- Cerebellar Hemisphere

Funcions of the cerebellum

- Equilibrium
- Maintenance of tone
- Coordination of movement

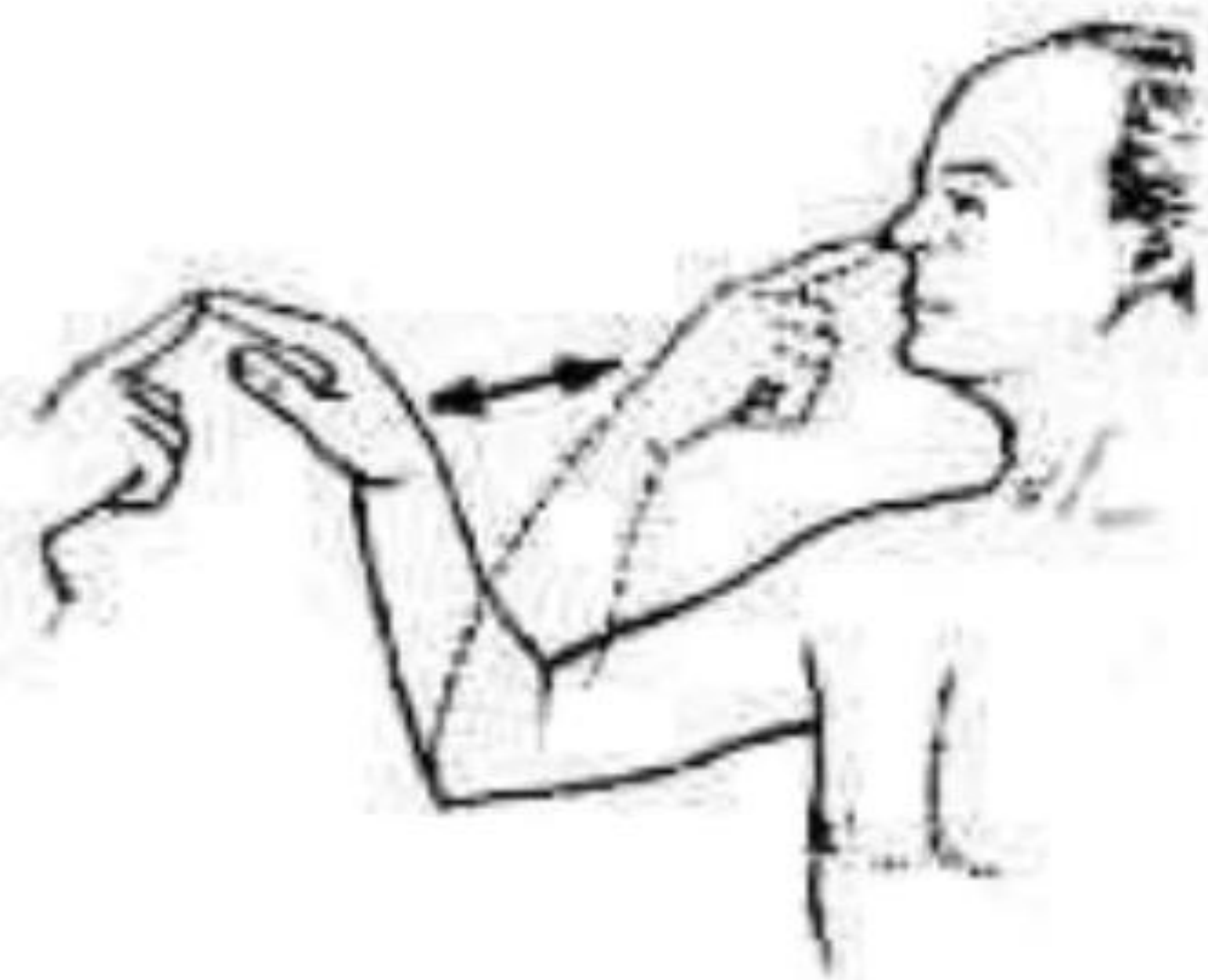
Ataxia

- Incoordination of voluntary motor activity with or without disequilibriation in the absence of motor weakness.

- Types:
  - Cerebellar ataxia
  - Sensory ataxia
  - Vestibular ataxia
  - Combined ataxia

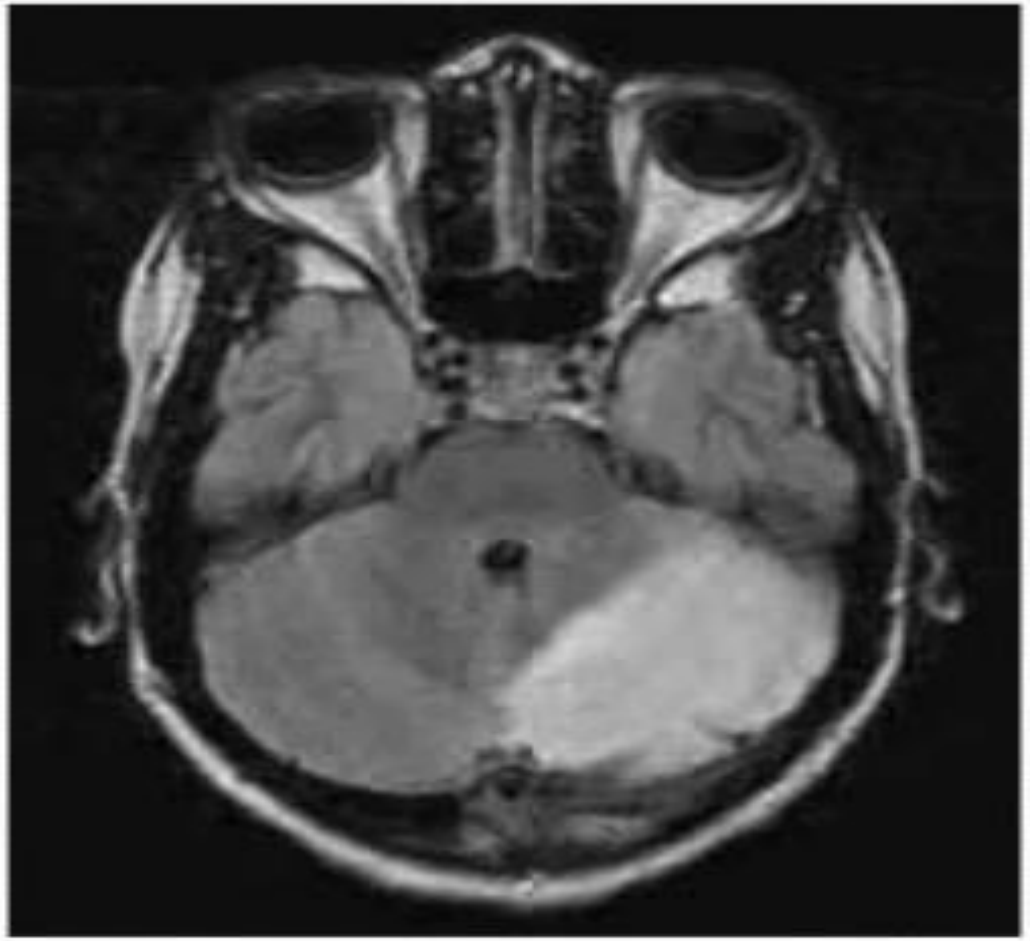
Cerebellar lobes	Lesion	Main clinical features
Flocculo-nodular lobe (Archicerebellum= vestibulocerebellum):	Loss of equilibrium	**Archicerebellar syndrome**: – Standing: trukal ataxia (swaying) – Walking: wide base gait or drunken gait.
Anterior lobe (paleocerebellum=spinocerebellum) :	Impairment of tone	Hypotonia and hyporeflexia that occur in both **Archicerebellar and Neocerebellar syndromes**
Posterior lobe (Neocerebellum= cerebro cerebellum):	Incoordination of movement	**Neocerebellar syndrome**: – Eye movement disorders : nystagmus – Staccato speech (explosive interrupted speech). – Head nodding. – Trunk titubation. – Intention kinetic tremors.

- ***Positive tests of Cerebellar functions***
  - Finger to nose
  - Heel to knee
  - Dysdiadokokinesia (inability to adequately terminate each phase of the movement)
  - Rebound
  - Buttoning and unbuttoning
  - Tandem gait.



Symptomatic ataxia

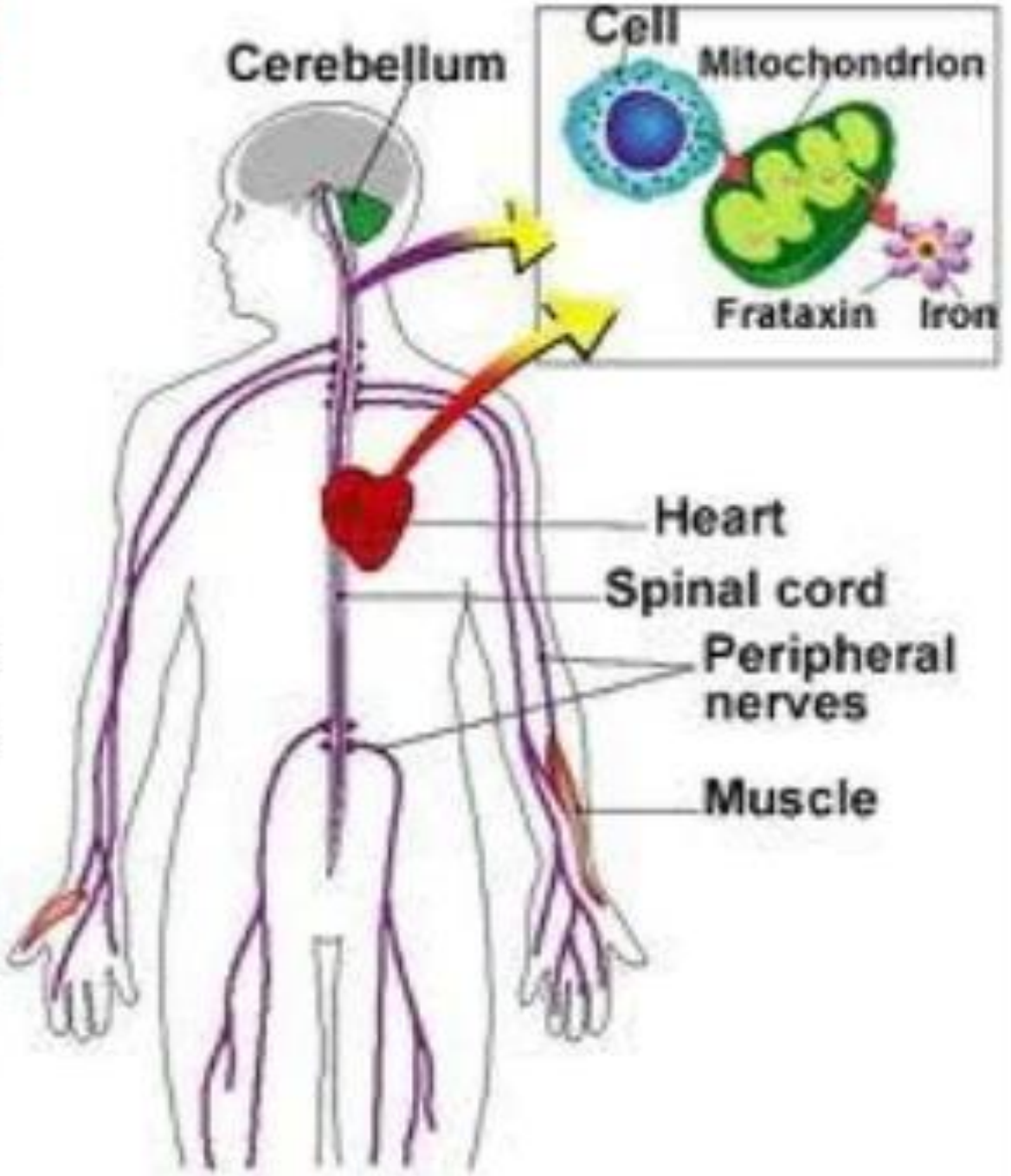
- Vascular ataxia
  - Cerebellar haemorrhage
  - Cerebellar infarction
- Tumours
  - Medulloblastoma
  - Astrocytoma
  - Metastasis
- Multiple sclerosis



Friedreich ataxia

Genetics:

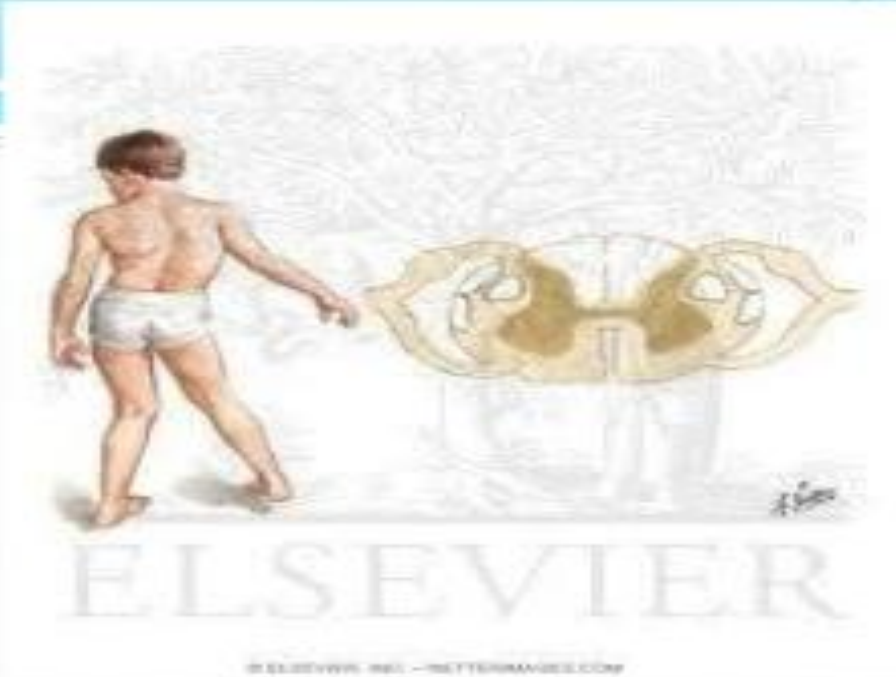
- AR disorder, chromosome 9.
- Repeat expansion disorder in
  called frataxin→ mitochondi
  loss and degeneration.
- **Epidemiology:**
- 1st decade of life, boys > girls



Friedreich ataxia

- Cerebellar Ataxia
- Pyramidal tracts--------Babiniski sign
- Posterior column-----lost deep sensation,diminshed reflexes
- Peripheral neuropathy----stock and glove hypoesthesia

Friedreich ataxia



Clinical picture:

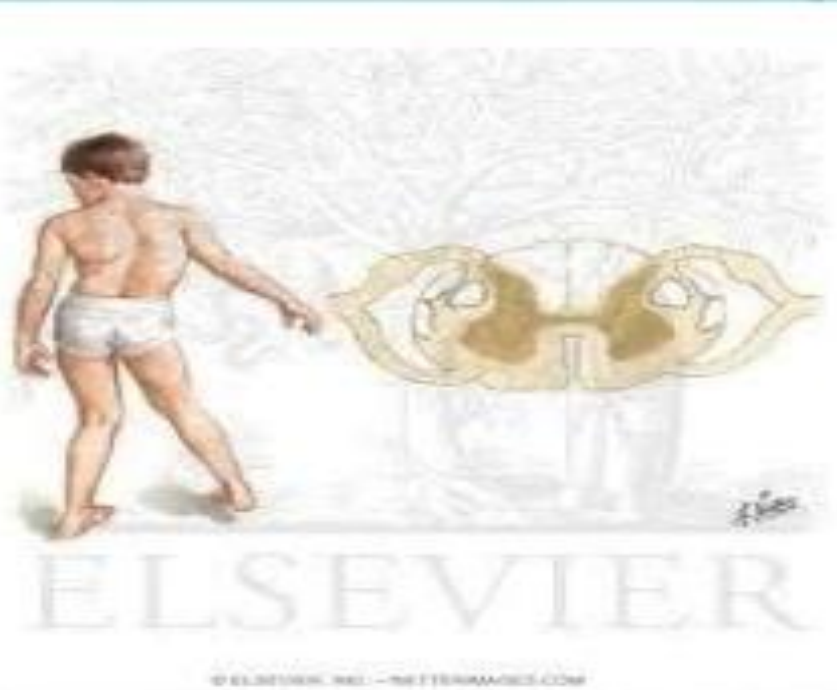
- Ataxia: archicerebellar type.
- Pyramidal signs: +ve Babiniski sign.
- Deep sensory loss.
- Peripheral neuropathy: stock and glove hypothesia.
- Hypotonia and hyporeflexia due cerebellar affection, deep sensory loss and peripheral neuropathy.
- Other features :skeletal deformities e.g. pes cavus, scoliosis and ♥cardiomyopathy.

Friedreich ataxia

Investigations:

- MRI cervical: atrophic cord.
- Genetic study.
- EMG and NC study: peripheral neuropathy.
- ECG,echocardiography.

Friedreich ataxia



Treatment: Supportive treatment and

Prognosis:

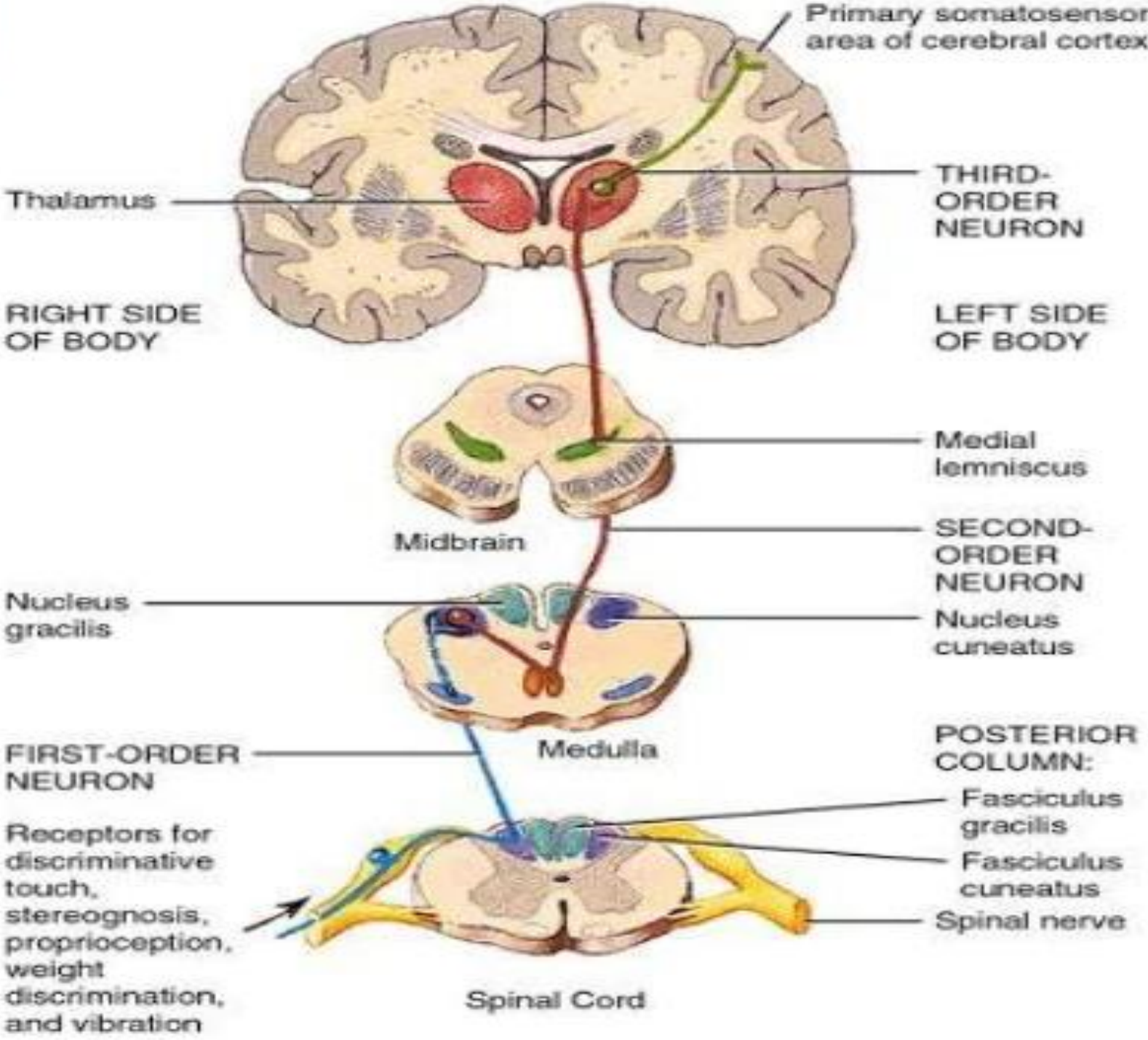
- Progressive disease, patient lose ambulance after 15 years.
- Mean age of death 40 -60 y from infection or cardiac disease.

Sensory ataxia

Definition: It is ataxia due to loss of the proprioceptive (deep) sensations, at any point in their pathway (see fig. 9).

Causes:

- Peripheral nerve: peripheral neuropathy specially diabetic, alcoholic and nutritional.
- Posterior root: tabes dorsalis.
- Posterior column: subacute combined degeneration of the cord.
- Medial lemniscus: brain stem lesions.
- Thalamus: thalamic syndrome.
- Cortical sensory area: parietal lobe lesions.


Primary somatosensory area of cerebral cortex
Thalamus
THIRD-ORDER NEURON
RIGHT SIDE OF BODY
LEFT SIDE OF BODY
Medial lemniscus
Midbrain
SECOND-ORDER NEURON
Nucleus gracilis
Nucleus cuneatus
Medulla
FIRST-ORDER NEURON
POSTERIOR COLUMN:
Fasciculus gracilis
Fasciculus cuneatus
Receptors for discriminative touch, stereognosis, proprioception, weight discrimination, and vibration
Spinal nerve
Spinal Cord

Sensory ataxia

Clinical picture:

- **Kinetic tremors** appear only on closure of the eyes.
- **Rhomberg's test**: when the patient stands with his feet close together & his eyes closed, his body sways & he may fall if not supported.
- **Stamping gait:** heavy strike of the ground on walking due to lost deep sensation.
- **Deep sensory loss**.
- **Hypotonia**
- **Hyporeflexia**

Vestibular ataxia

Definition: It is ataxia due to lesions of the vestibular division of the vestibulocochlear nerve .

Causes:

- Meniere's disease.
- Labyrinthitis.
- Acoustic neuroma.

Clinical picture:

- Vertigo, tinnitus, deafness & vestibular nystagmus.


THANK
YOU