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Cerebellum

M1 – CNS Sequence

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Winter, 2009

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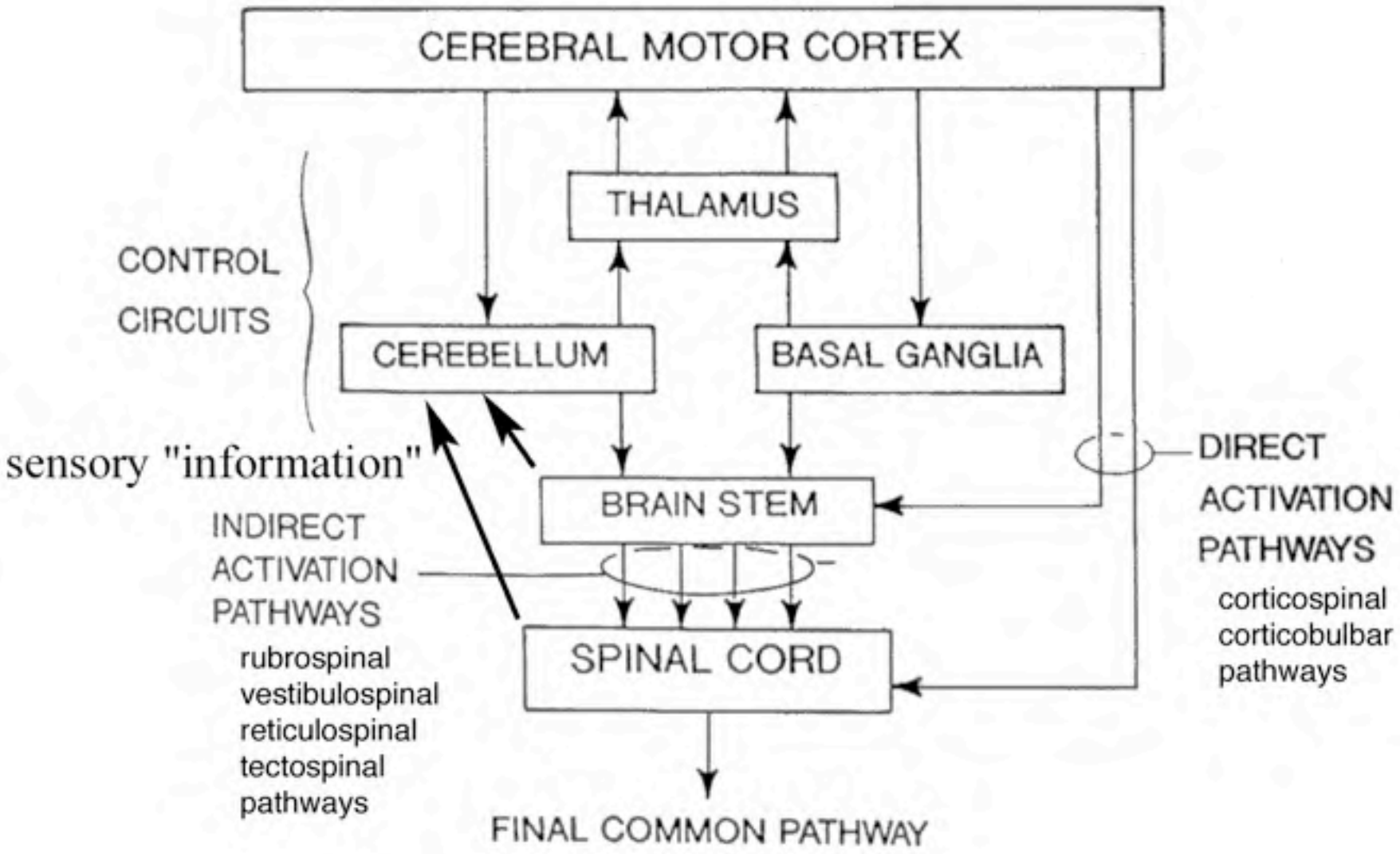
The topic of today's lecture is the cerebellum. The principal function of the cerebellum is to coordinate goal-directed and spontaneous movements, including eye movements, and regulate posture.

I. Gross anatomy of the cerebellum
II. Internal cellular anatomy and synaptic connections (circuitry)
III. Functional organization (3 functional domains)
- **a. vestibulocerebellum**
- **b. spinocerebellum (2 subdivisions)**
- **c. cerebrocerebellum**

IV. Motor learning and plasticity
V. Clinical aspects of the cerebellum
VI. The cerebellum and cognition
VII. Blood supply to the cerebellum

A schematic model of the motor system. The cerebellum influences movements via connections to both the brainstem and cerebral cortex



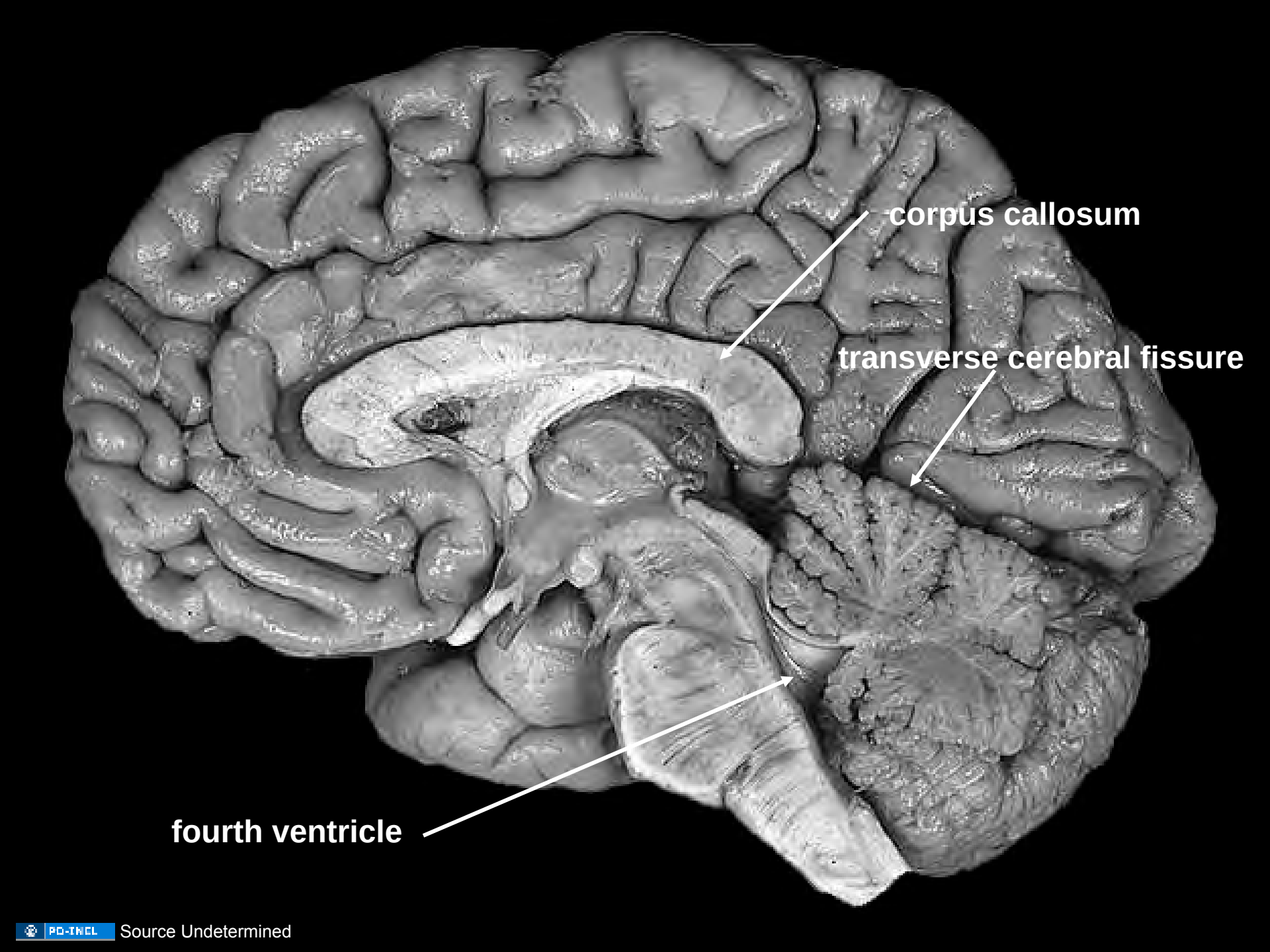
GENERAL FEATURES:

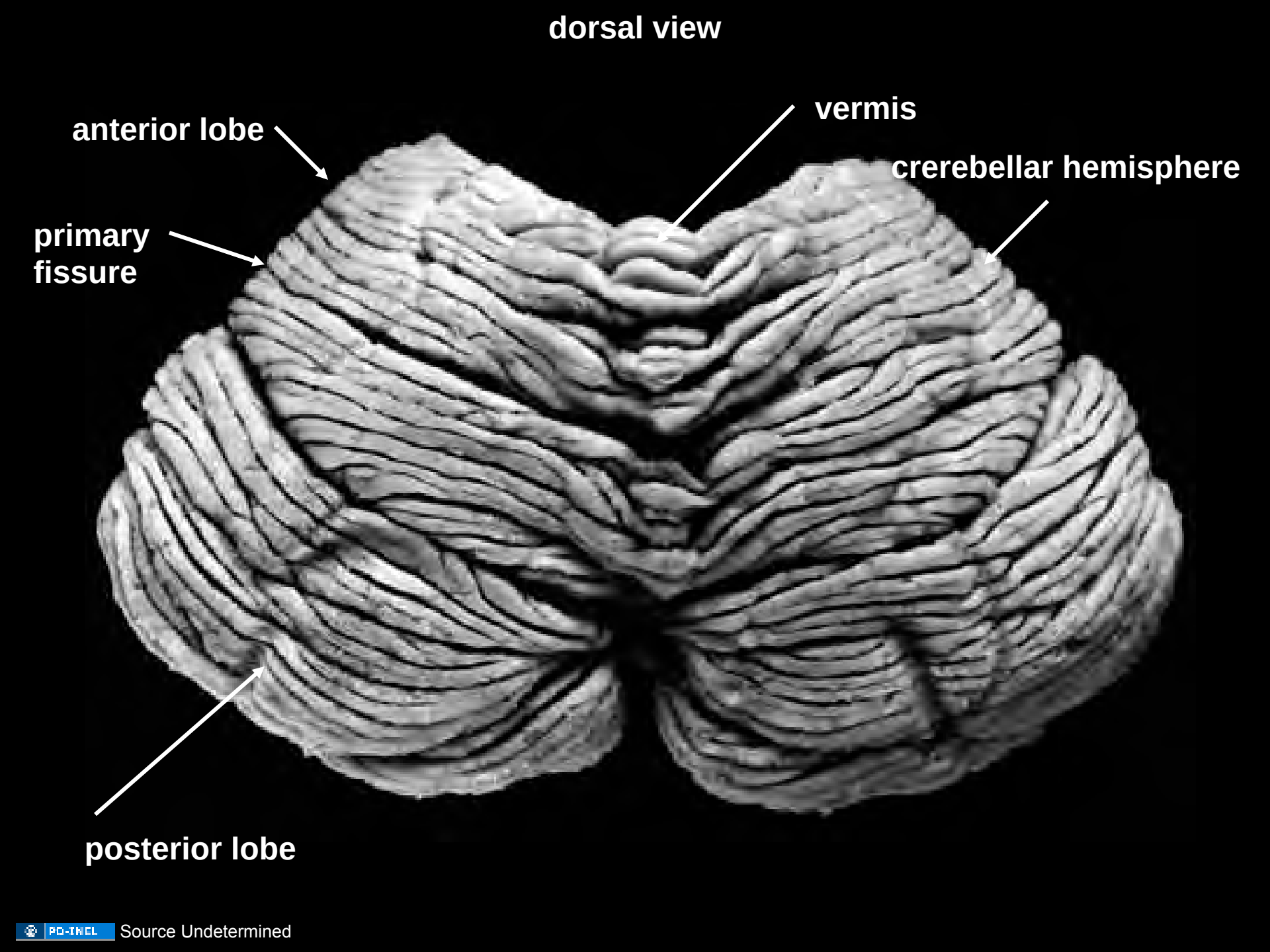
The cerebellum regulates the following 5 functions:

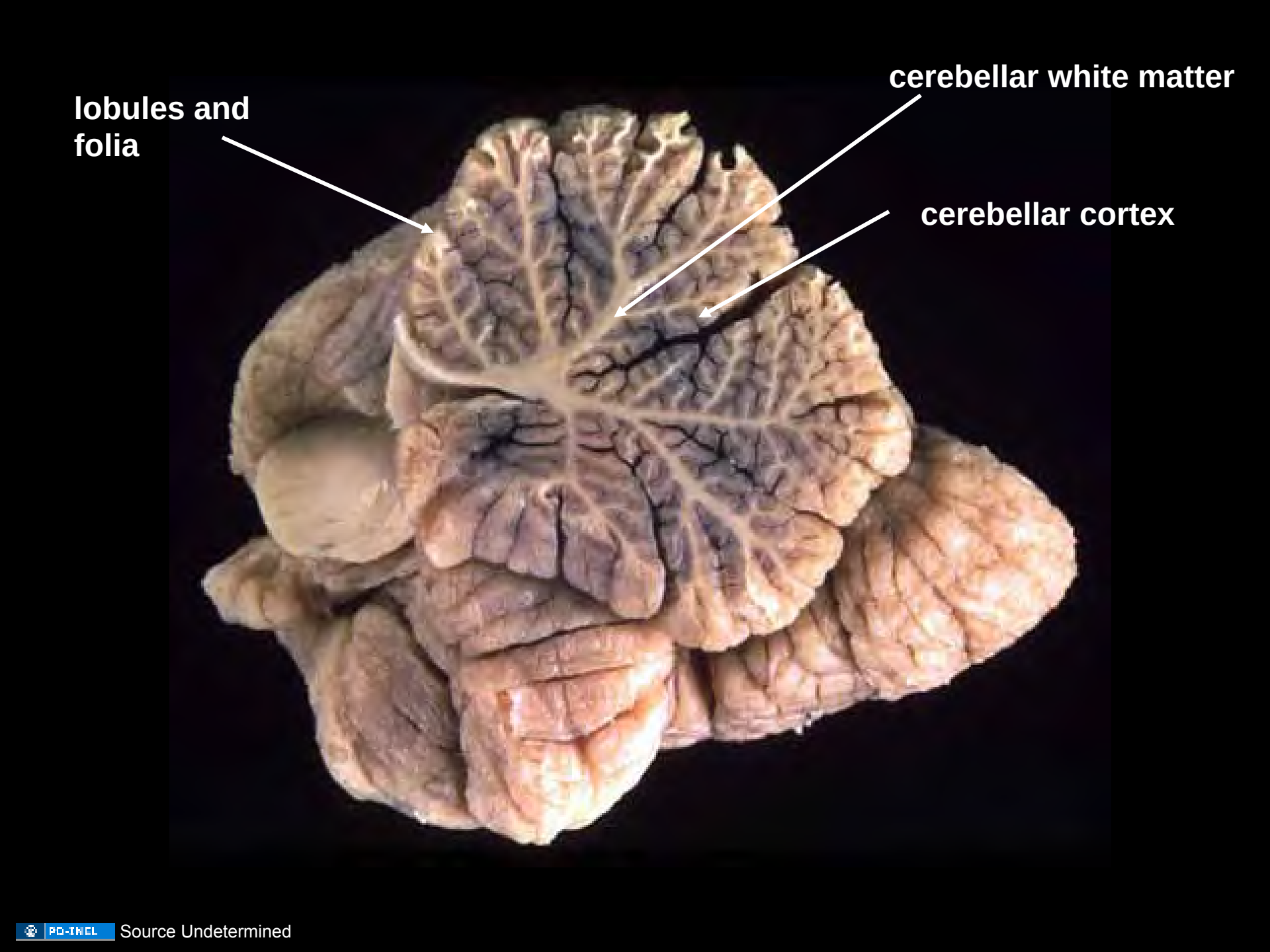
1) muscle tone
2) coordination of goal directed and spontaneous movements
3) posture and balance
3) eye movements
4) motor learning
5) some cognitive functions (e.g., language acquisition)

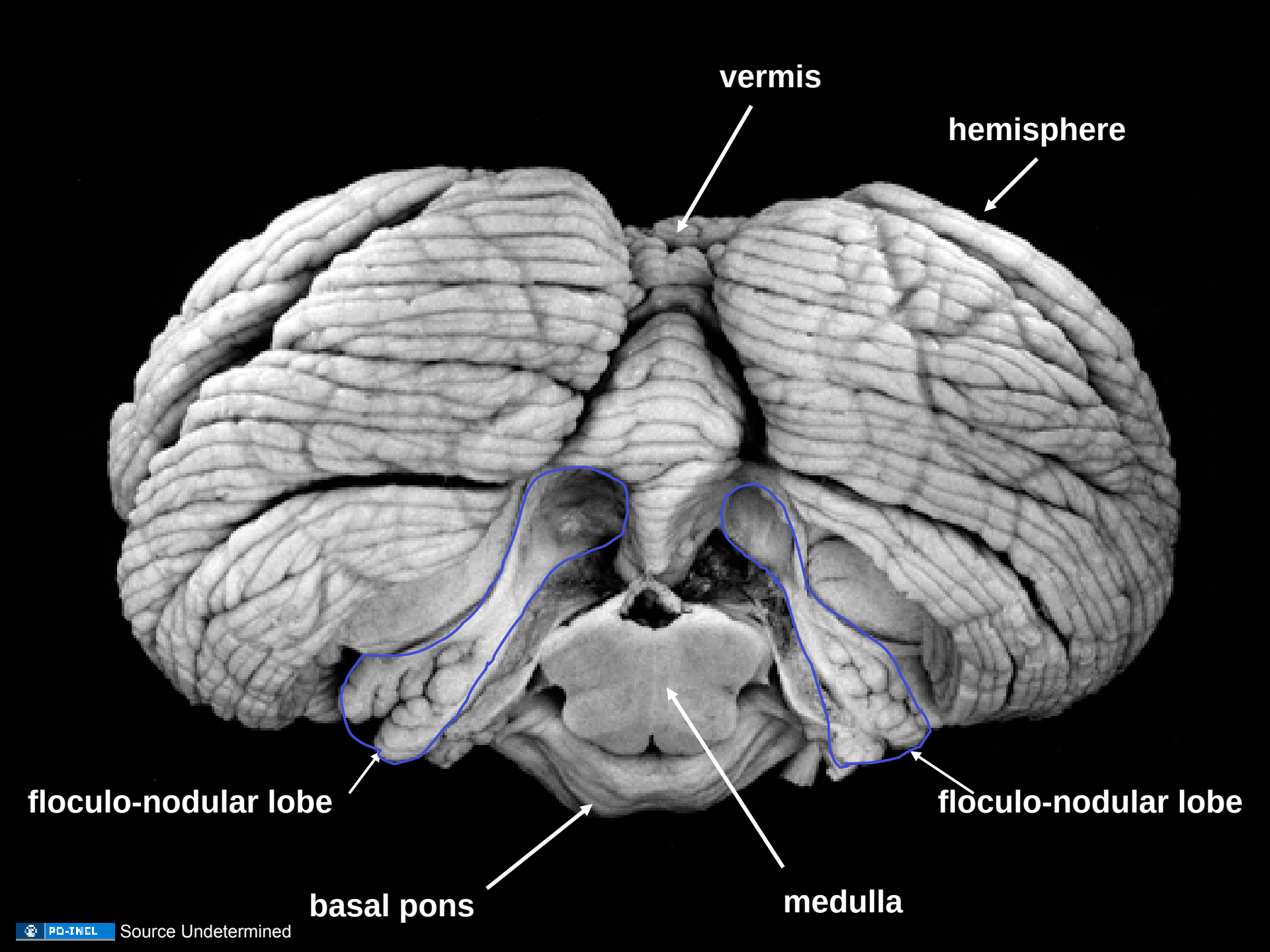
•Each hemisphere of the cerebellum influences motor activity on the ipsilateral half of the body

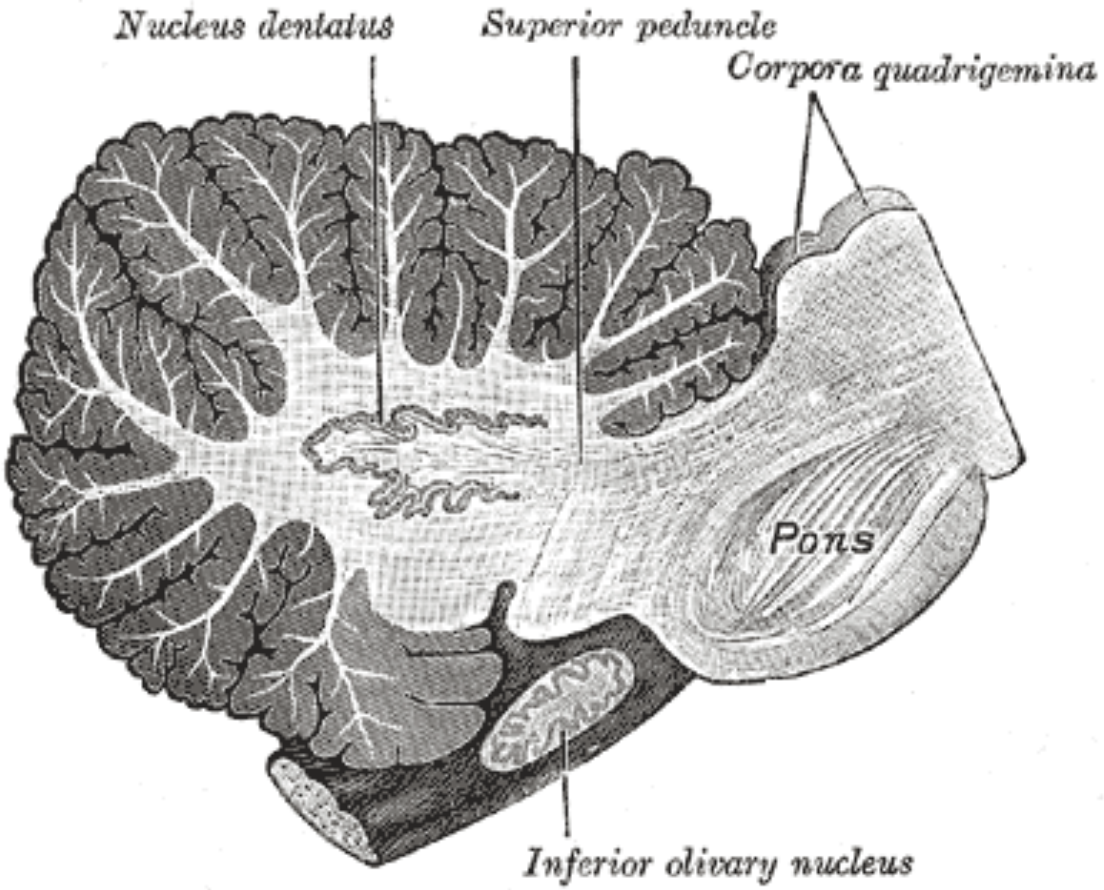
•The cerebellum compares the motor plan (intent) created in the cortex with motor performance (reported from the periphery) and functions to smoothen and coordinate the movements. This is accomplished by making synaptic contacts with the brainstem 'motor' centers and the cerebral hemispheres.











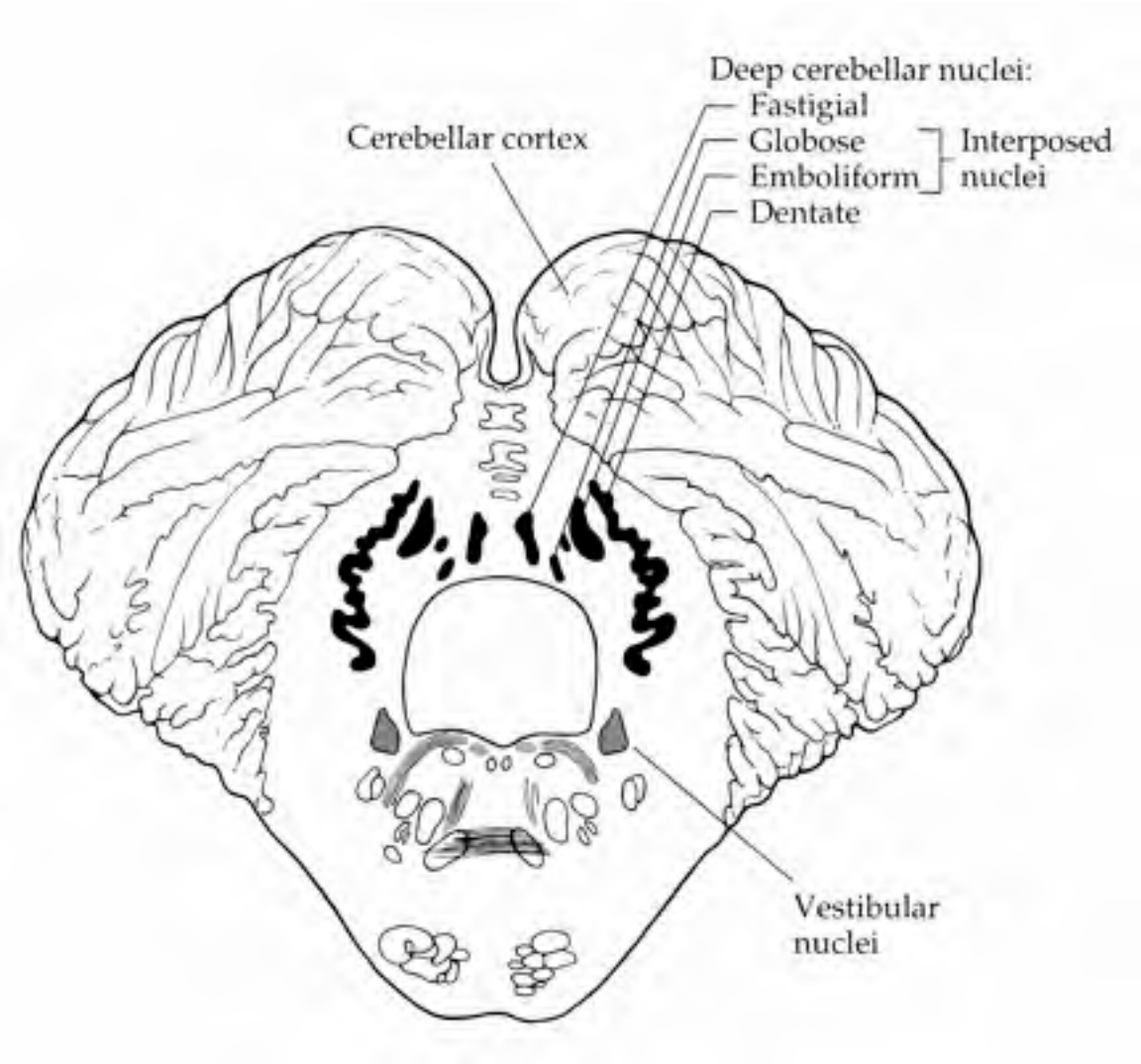
(Emboliform, globose, fastigial nuclei visible but not labeled)

there are three pairs of nuclei that lie within the cerebellar white matter, known as the 'deep cerebellar nuclei':

(from lateral to medial)

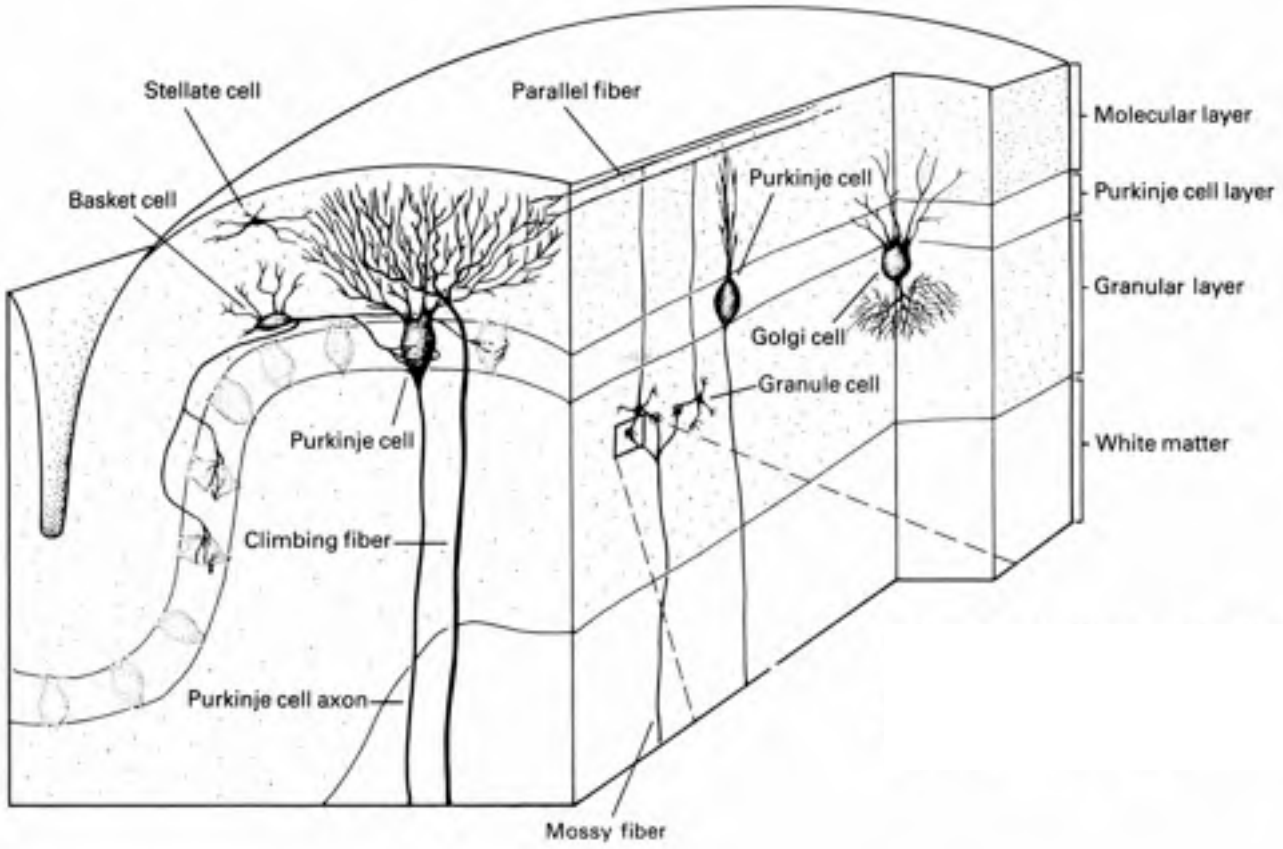
- **dentate**
- **emboliform**
- **globose**
- **fastigial**

interposed nucleus

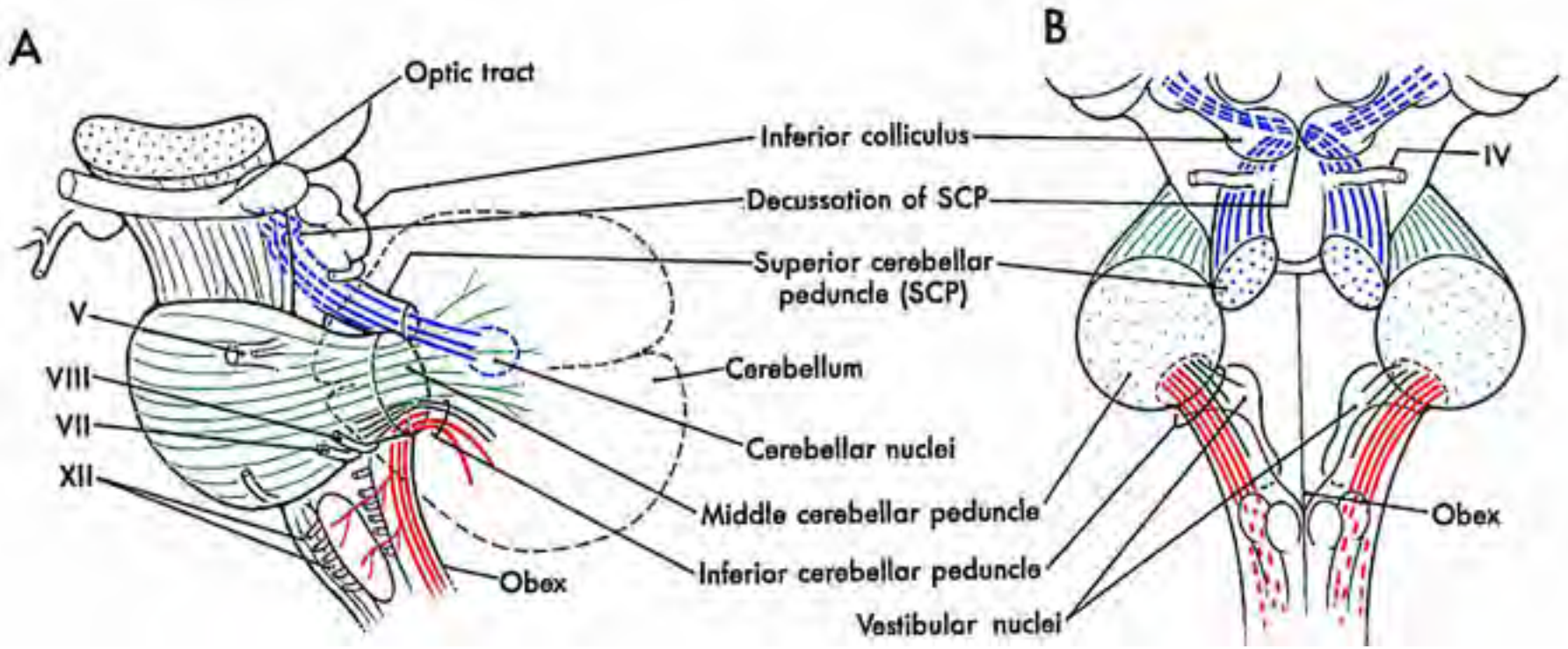


cross section through a portion of a single folium

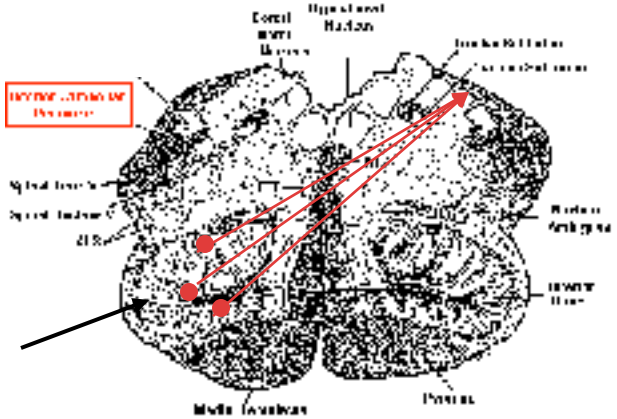
- the cerebellum has three cellular layers (plus underlying white matter)
- there are three kinds of neurons in the cortex, Purkinje cell, granule cell, and interneurons (3 types)



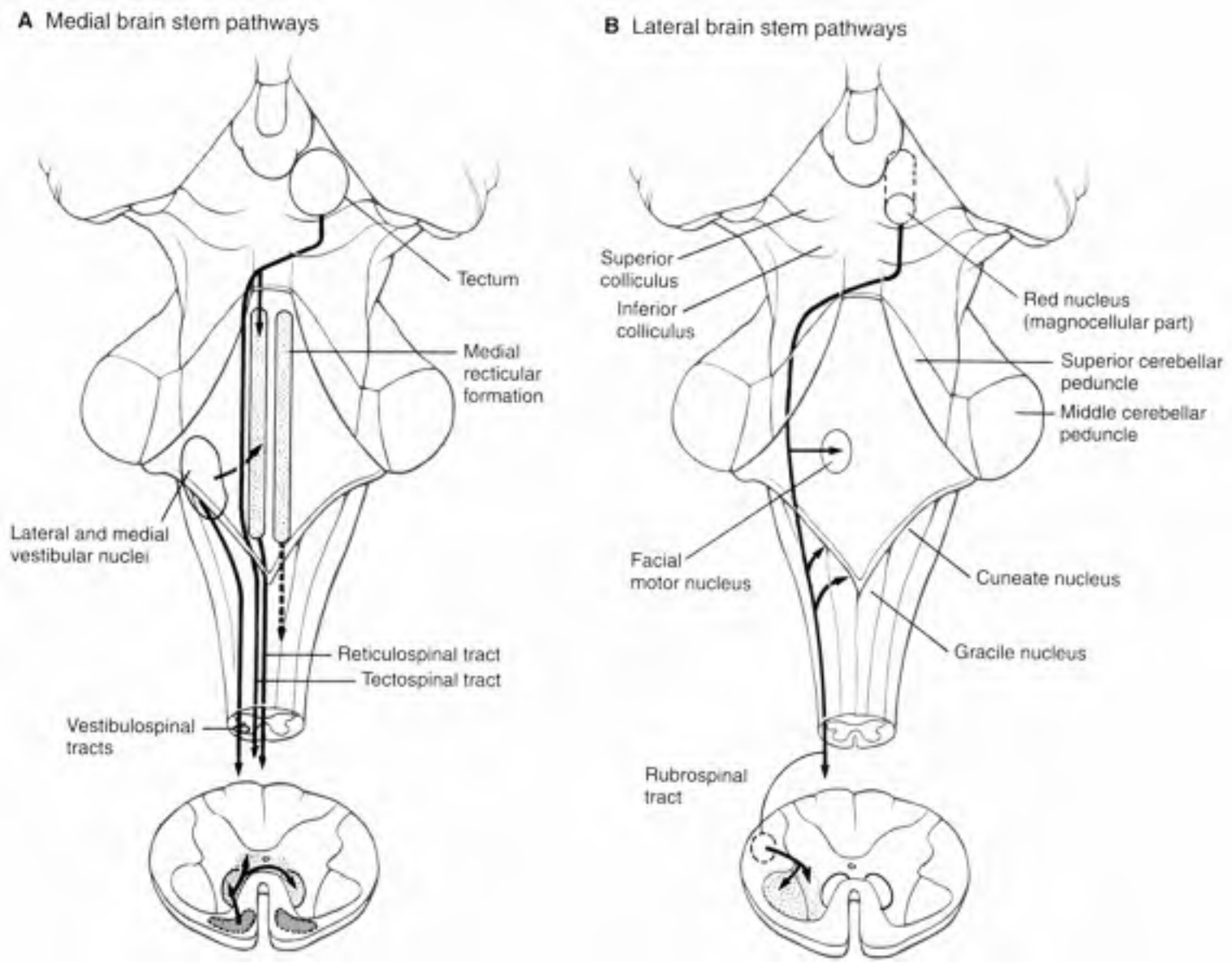
- climbing fibers originate from the contralateral inferior olive
- mossy fibers originate from all other afferents that enter the cerebellum



superior - mostly efferent
middle - afferent
inferior - mostly afferent

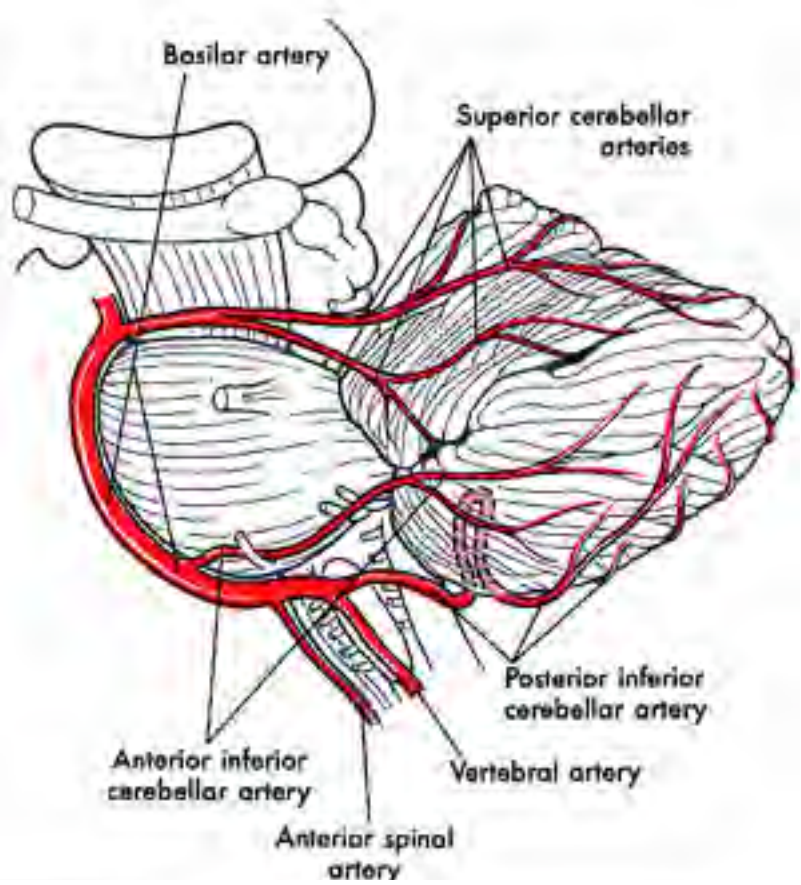


inferior olive



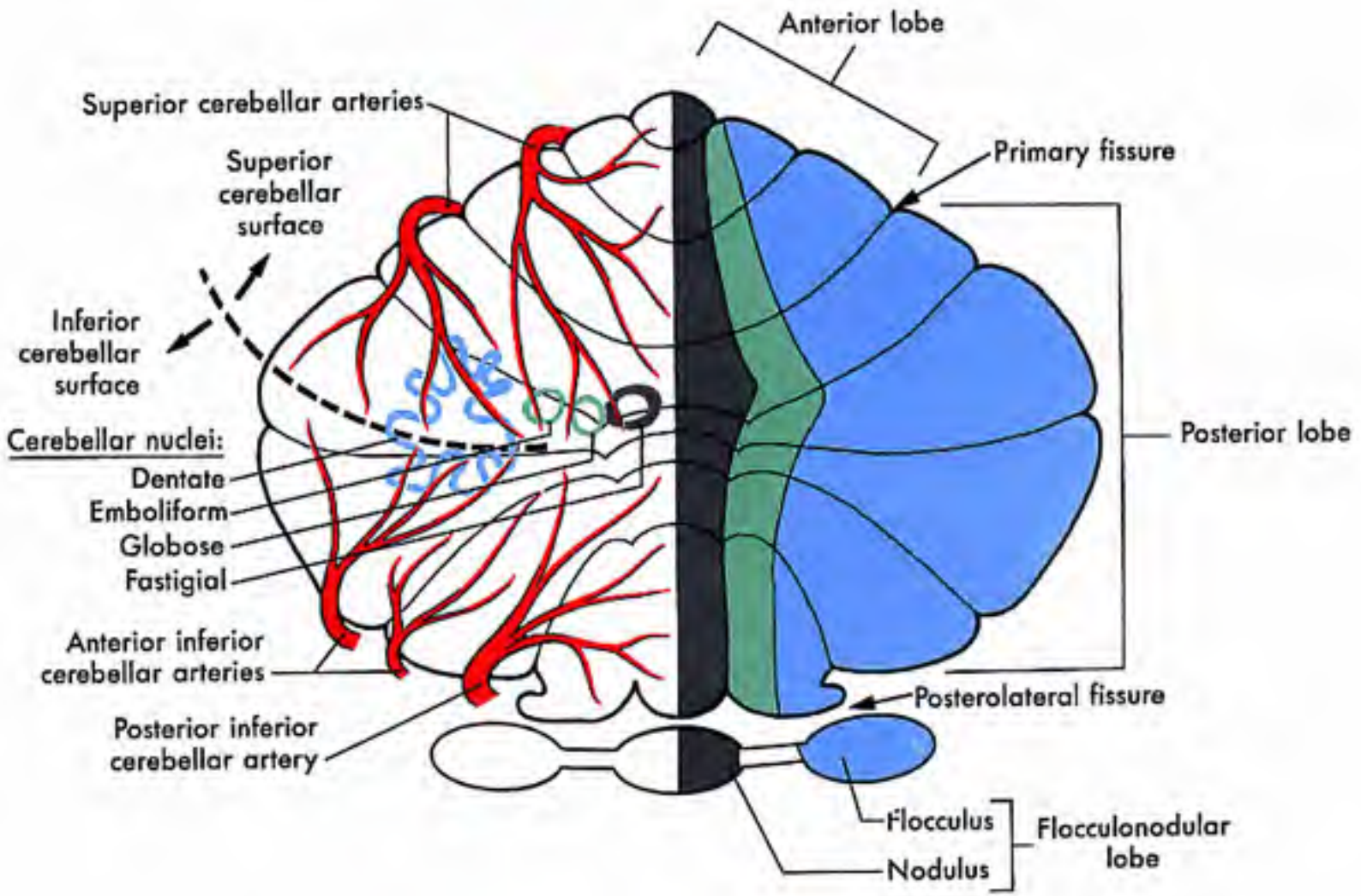
The cerebellum is supplied by vessels that branch from the basilar artery -

- superior cerebellar arteries
- anterior inferior cerebellar arteries
- posterior inferior cerebellar arteries

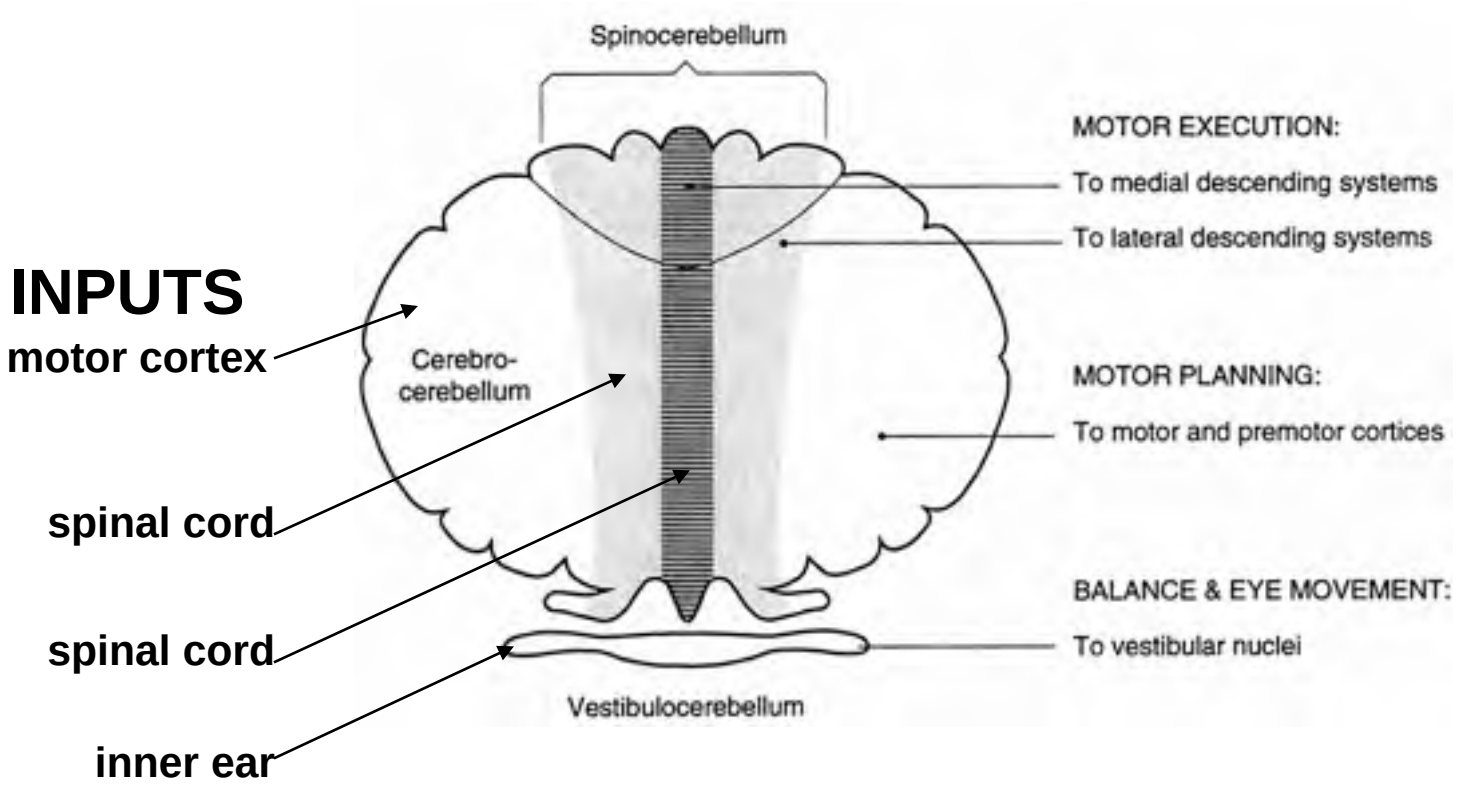


 Hanes. Fundamental Neuroscience. Churchill Livingstone, 2002. 2nd ed.

blood supply **longitudinal, functional domains**



Summary diagram of the inputs and outputs of the cerebellum

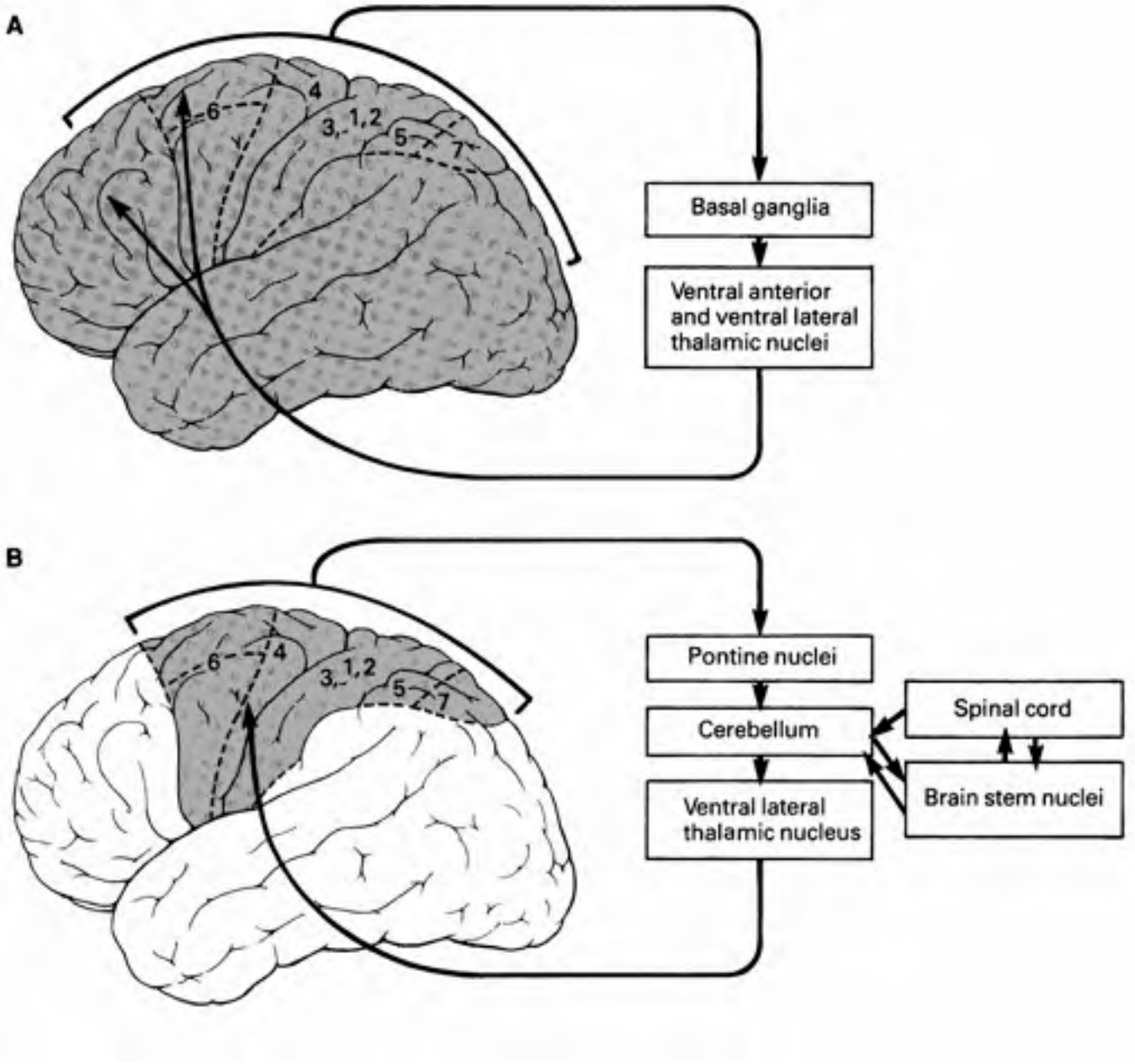


The cerebellum is believed to be the neural substrate critical to learning complex motor skills, e.g., riding a bike; professional musicians

Loss of cerebellar function does not produce paralysis or the inability to initiate a movement. Rather, cerebellar disease produces disturbances in the coordination and fine control of movements and posture.

Basal ganglia

Cerebellum



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