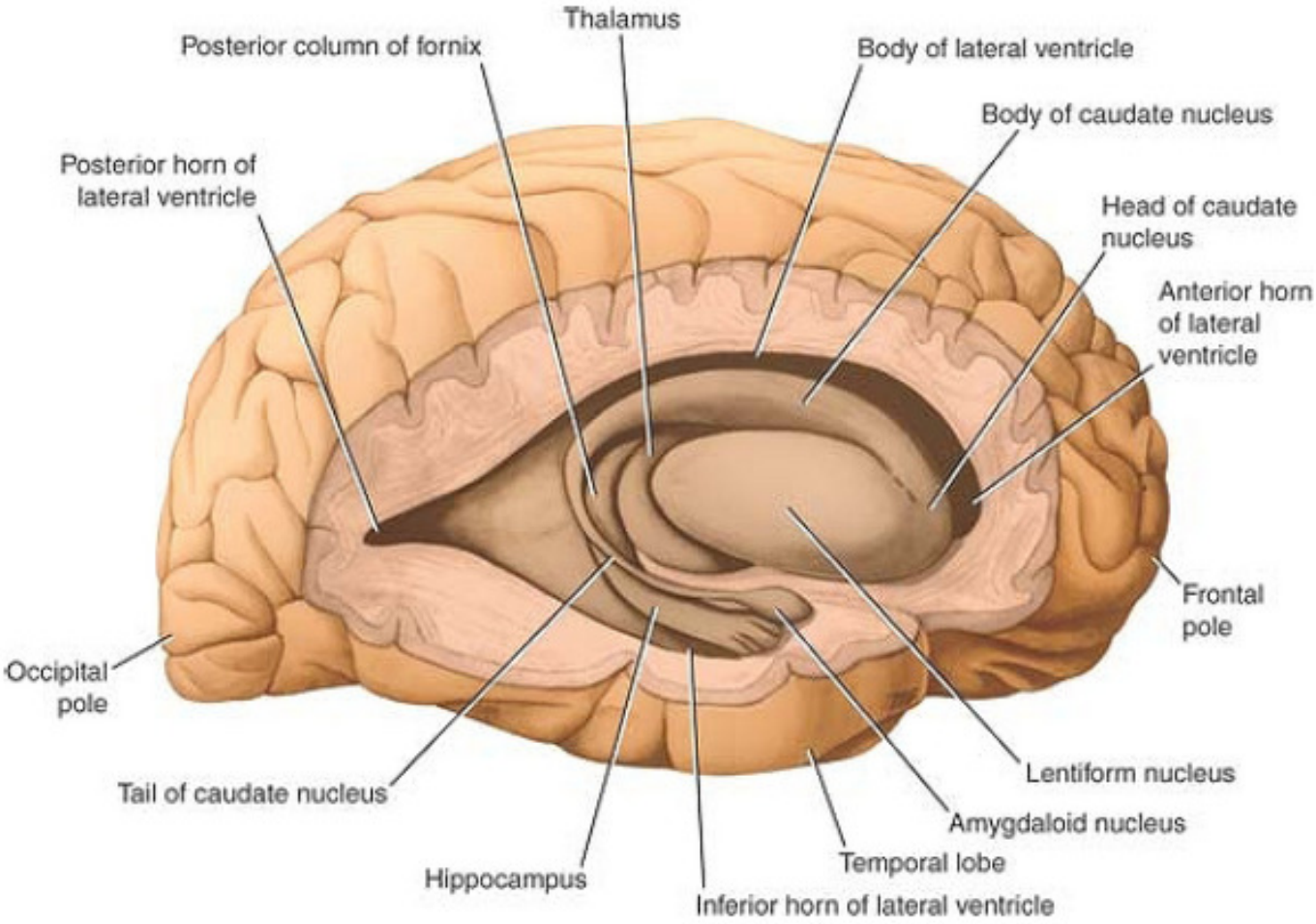
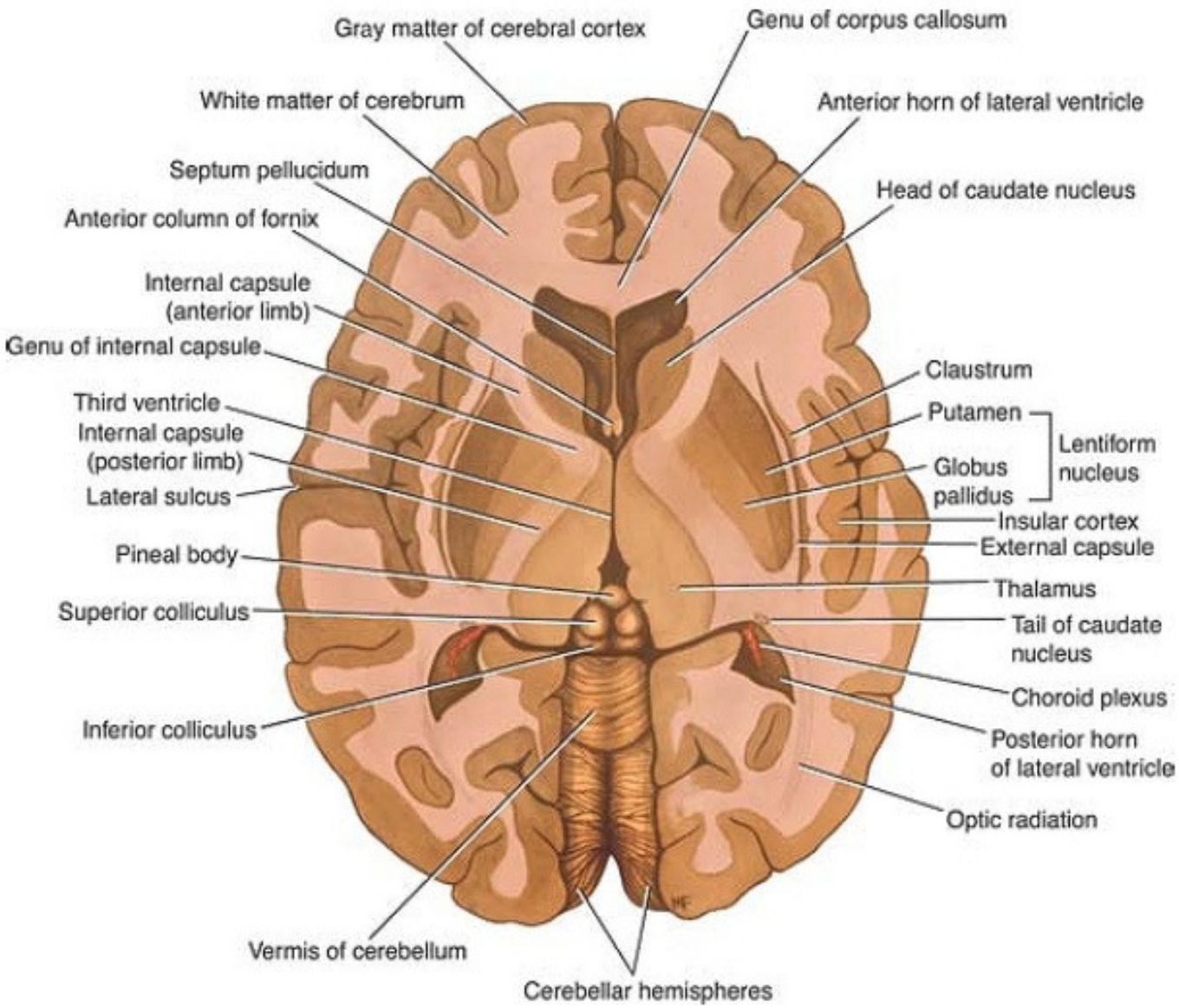
Basal nuclei

- collection of masses of gray matter situated within each cerebral hemisphere.
- Corpus striatum
  - Caudate nucleus
  - Lentiform nucleus.
    - **Putamen**
    - **Globus pallidus**
- Amygdaloid nucleus
- Claustrum.



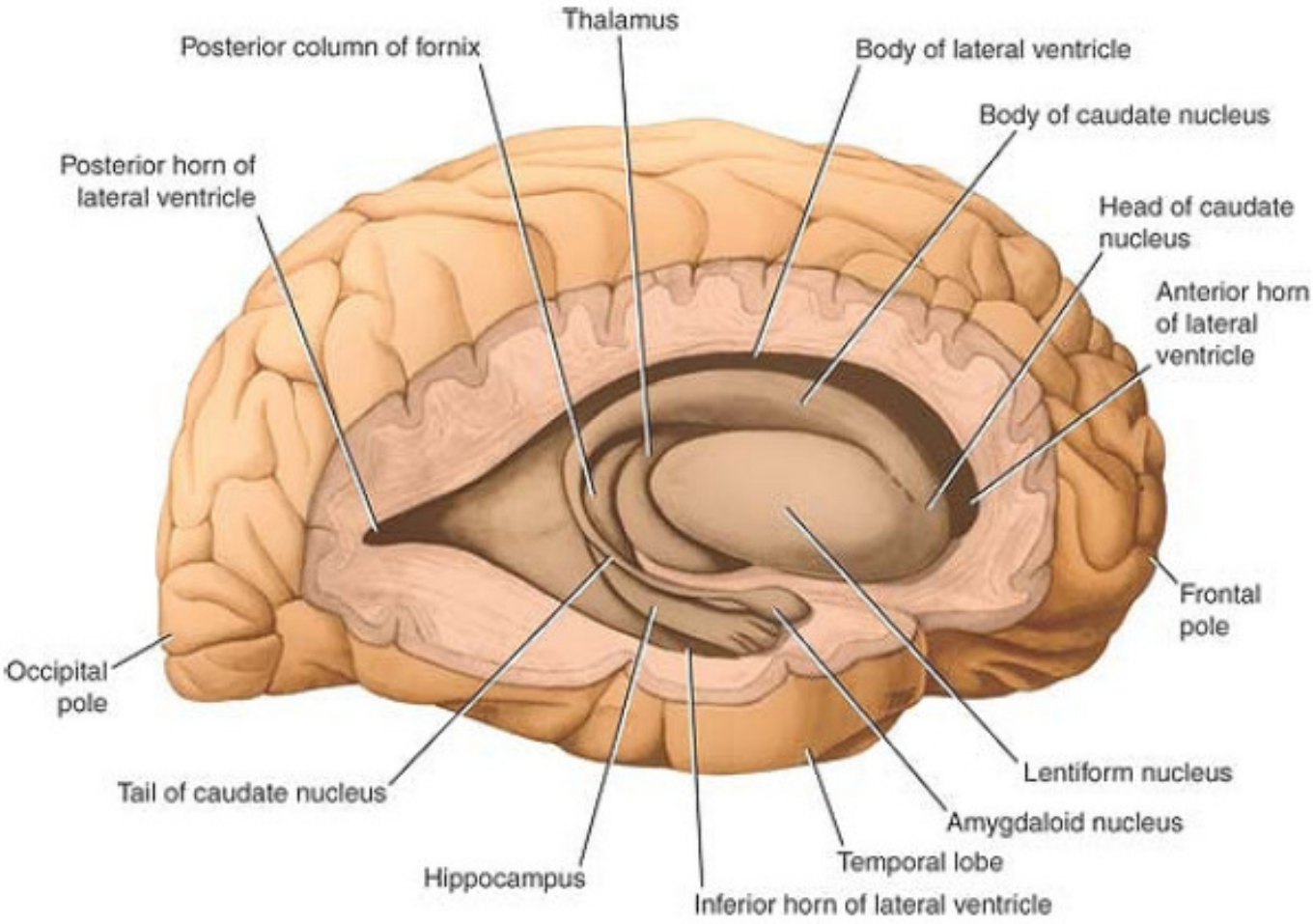
Corpus striatum

- Divided by **internal capsule** (a band of nerve fibers) **into:**
  - Caudate nucleus
  - Lentiform nucleus.
- Caudate nucleus: large C-shaped mass of gray matter, closely related to the lateral ventricle and lies lateral to the thalamus
  - Head
  - Body
  - Tail



Caudate nucleus

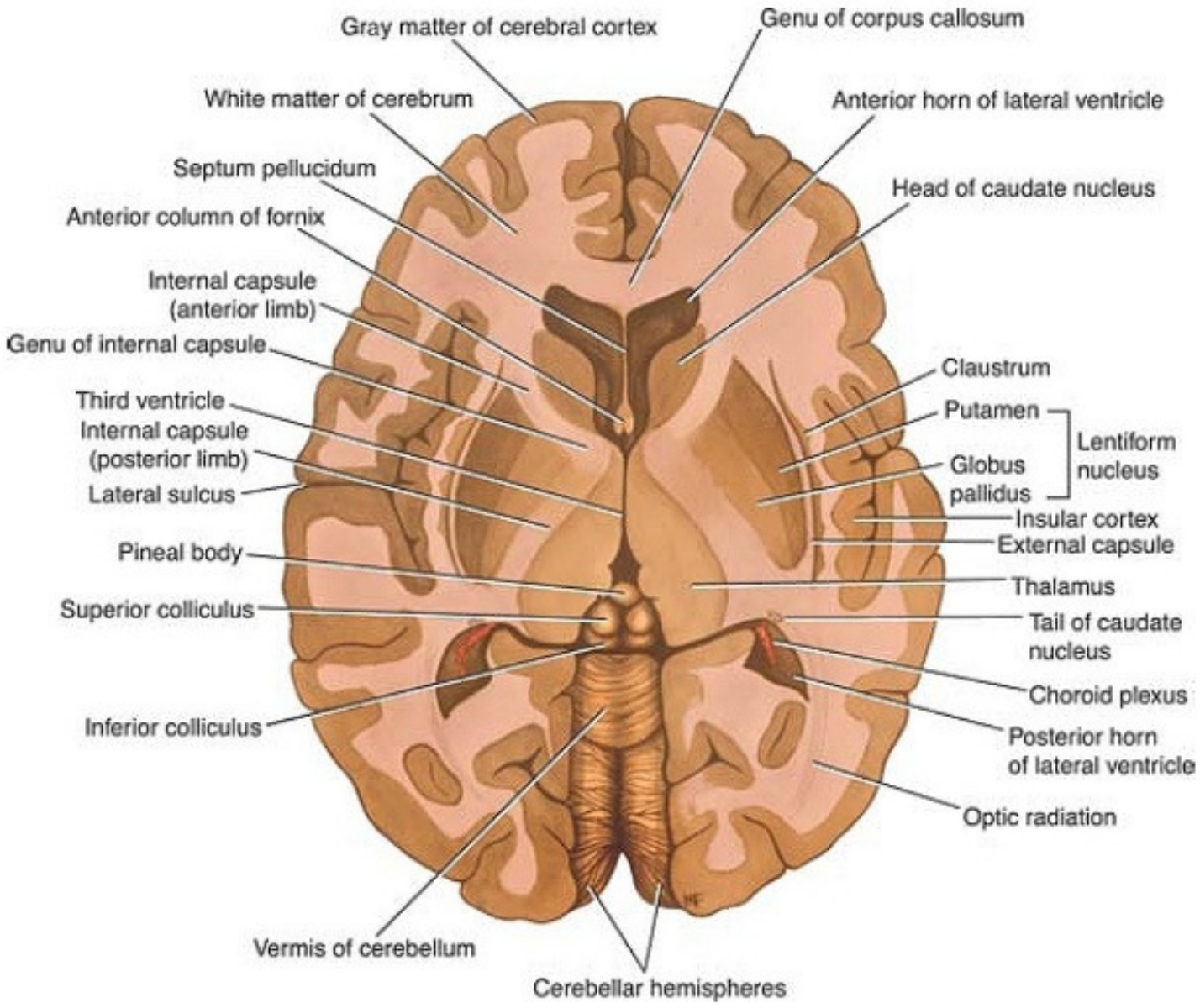
- **Head**: large and rounded and forms the lateral wall of the anterior horn of the lateral ventricle
- **Body**: long and narrow and is continuous with the head in the region of the interventricular foramen. forms part of the floor of the body of the lateral ventricle.



- **Tail**: long and slender and is continuous with the body in the region of the posterior end of the thalamus. It follows the contour of the lateral ventricle and continues forward in the **roof of the inferior horn** of the lateral ventricle. It terminates anteriorly in the **amygdaloid nucleus**

Lentiform nucleus

- wedge-shaped mass of gray matter whose broad convex base is directed laterally and whose blade is directed medially
- **Medially:** internal capsule.
- **Laterally:** external capsule (thin sheet of white matter),which separates it from the **claustrum**



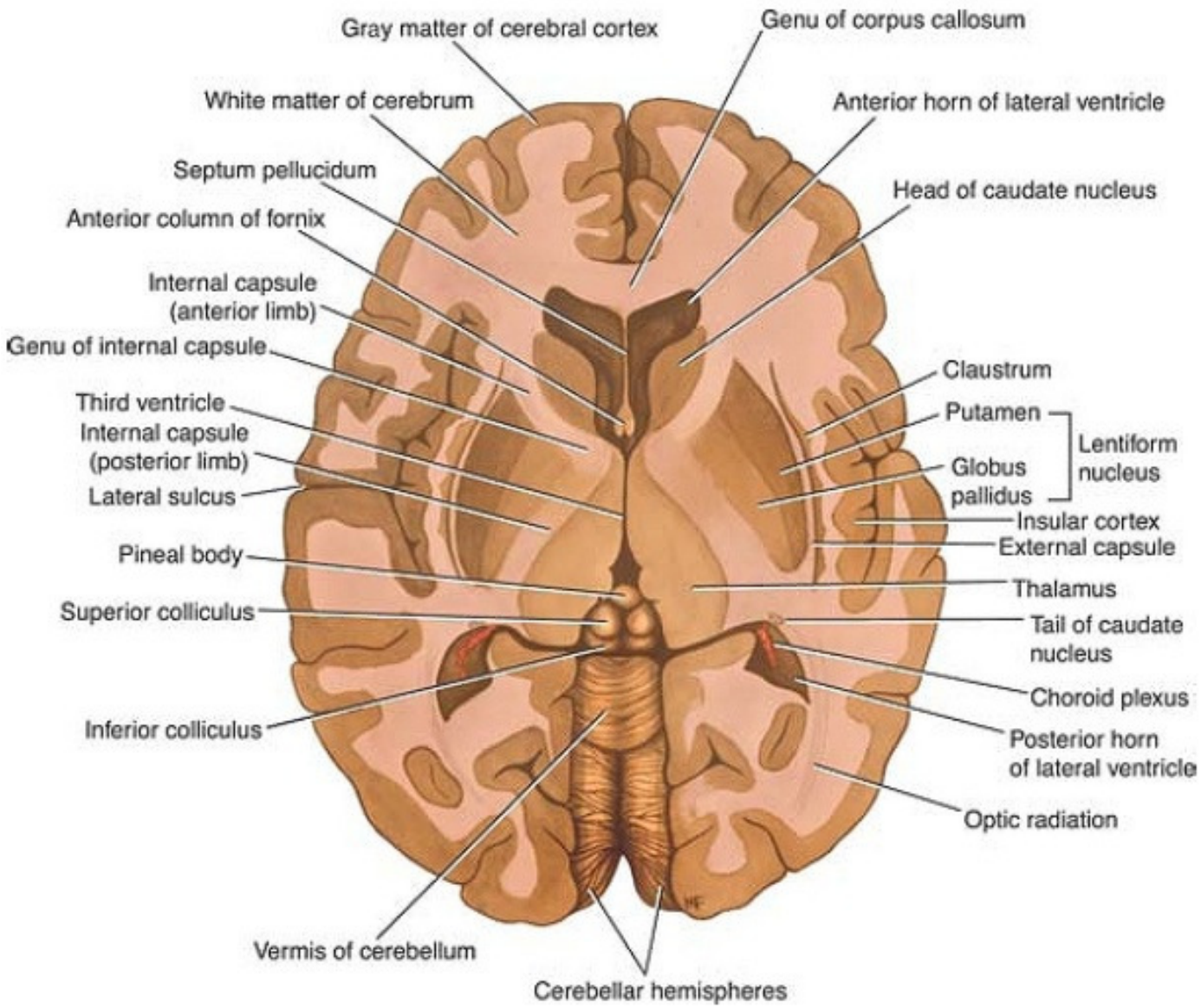
Lentiform nucleus

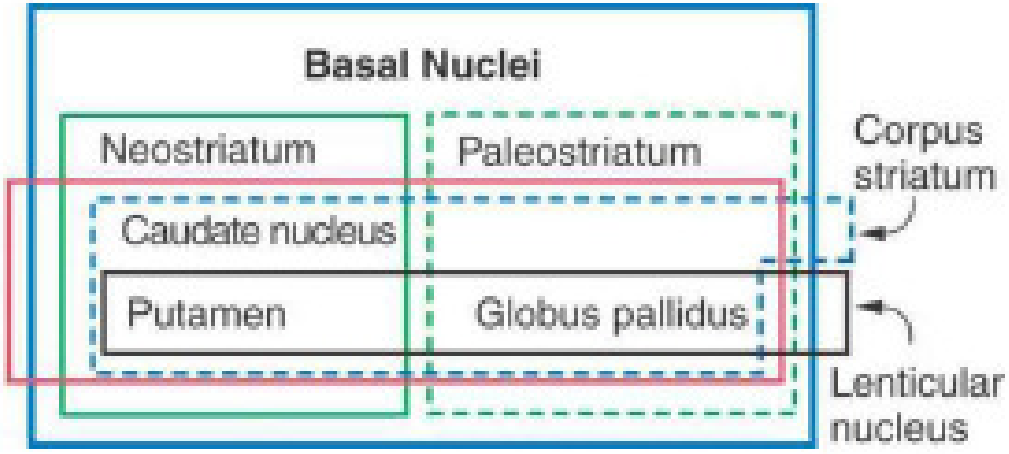
Divided into:

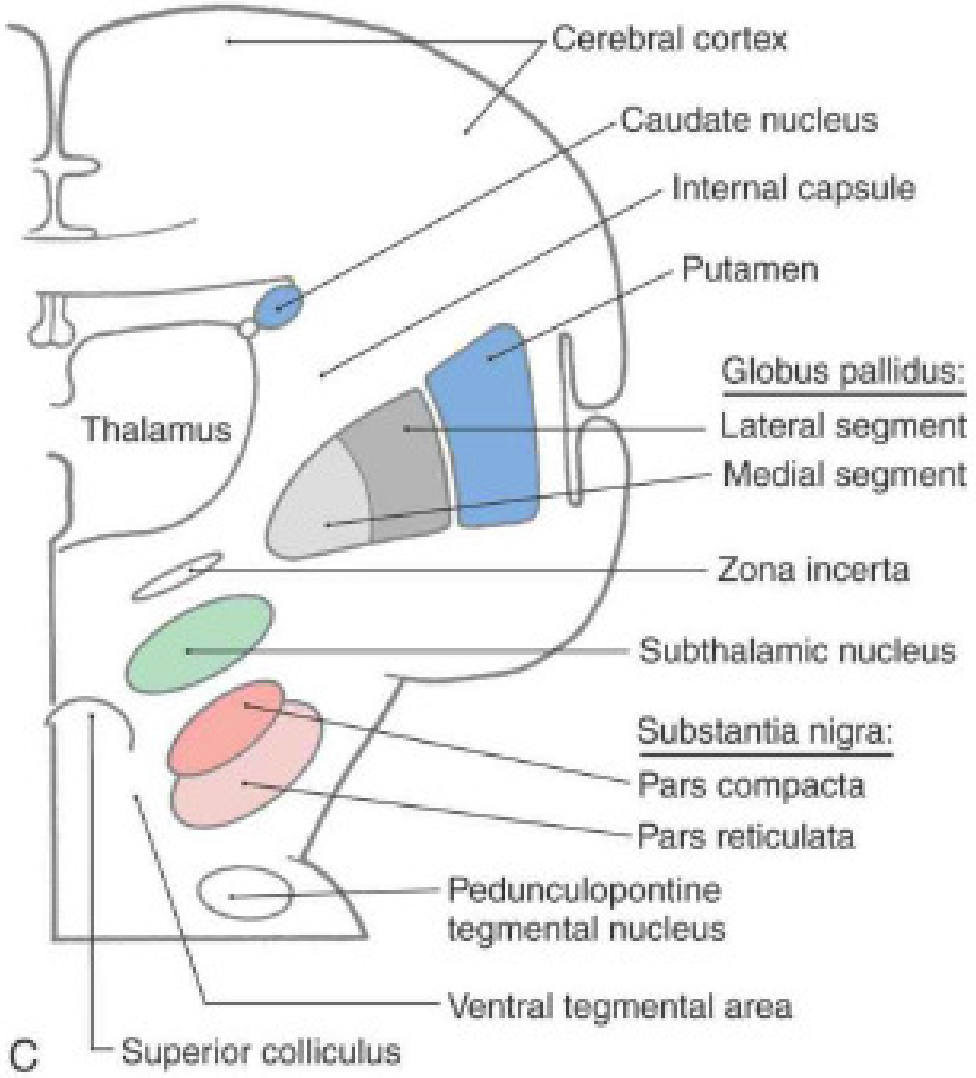
- **Putamen nucleus**: a larger, darker lateral portion
- **Globus pallidus**: inner lighter portion
  - Internus
  - Externus

Claustrum:

- thin sheet of gray matter that is separated from the lateral surface of the lentiform nucleus by the **external capsule Lateral to the claustrum** is the subcortical white matter of the insula.

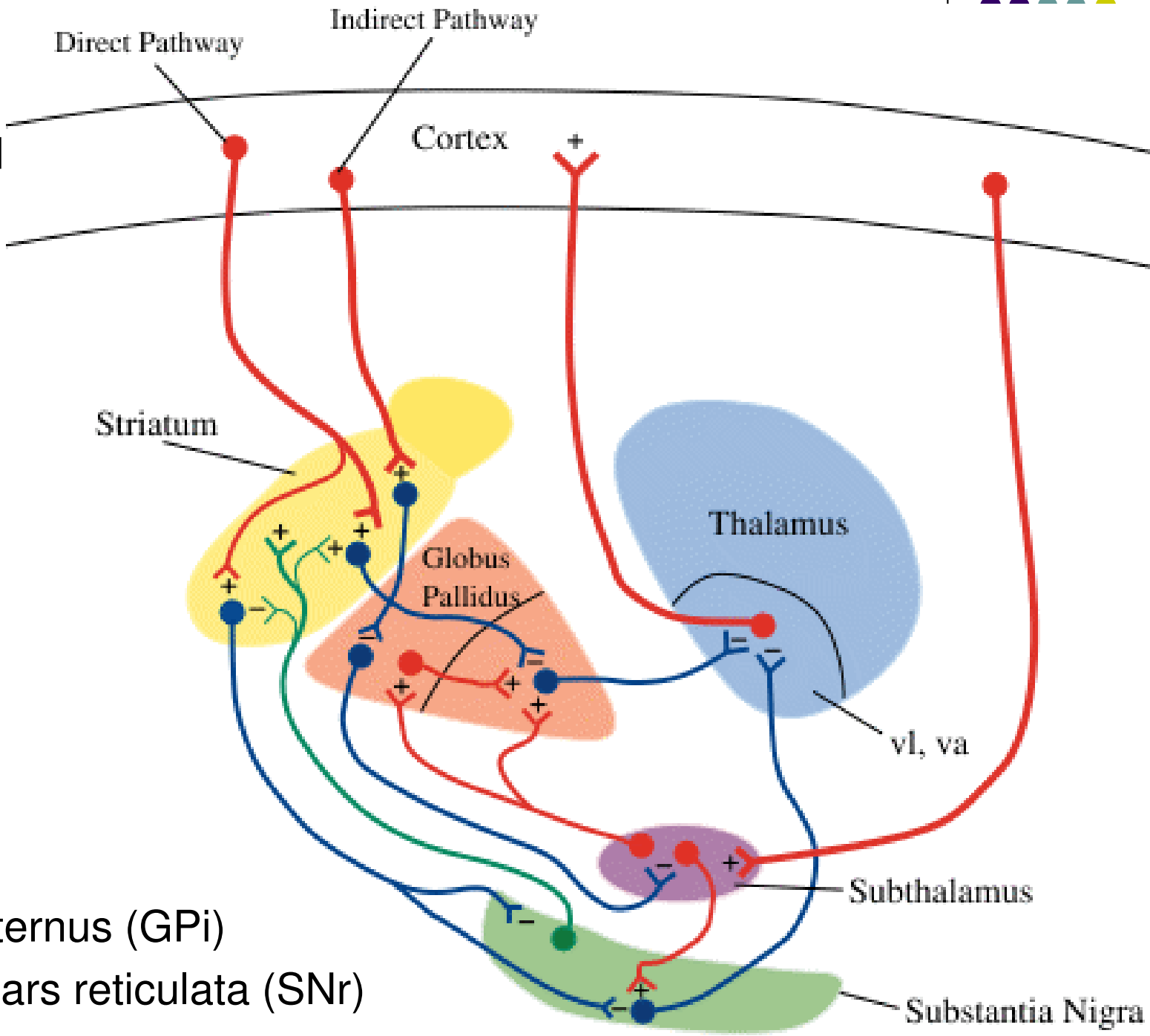



Basal Nuclei
Neostriatum
Paleostriatum
Caudate nucleus
Putamen
Globus pallidus
Corpus striatum
Lenticular nucleus


Cerebral cortex
Caudate nucleus
Internal capsule
Putamen
Thalamus
Globus pallidus:
Lateral segment
Medial segment
Zona incerta
Subthalamic nucleus
Substantia nigra:
Pars compacta
Pars reticulata
Pedunculopontine tegmental nucleus
Ventral tegmental area
Superior colliculus
C

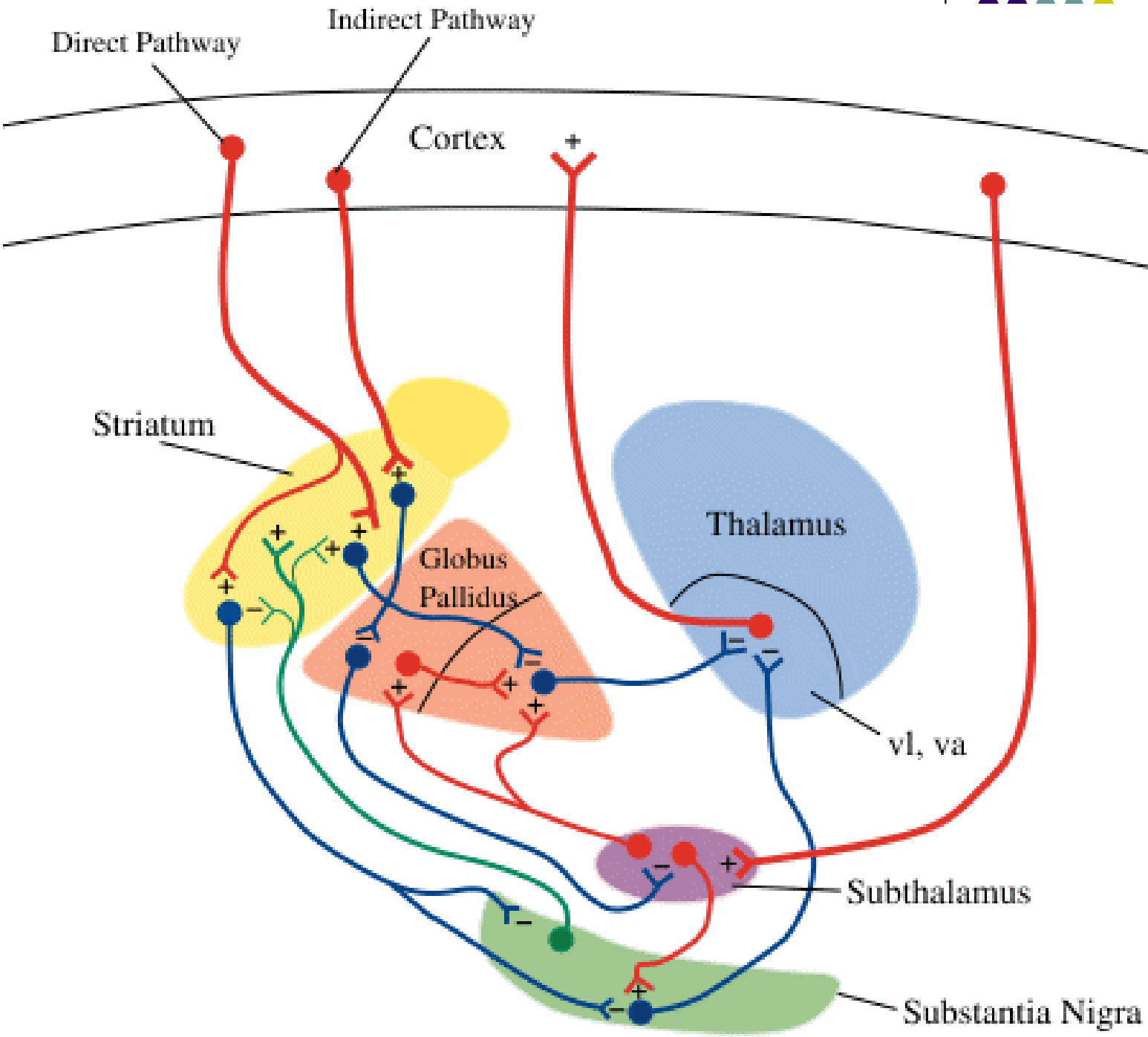
Direct pathway

- Corticostriate Fibers (+)
- Striatopallidal and striatonigral fibers (-)
- Pallidothalamic fibers nigrothalamic fibers (-)
- Thalamocortical fibers (+)
- The net effect is to **increase** the activity of the thalamus and the cerebral cortex
  - ➢ globus pallidus internus (GPi)
  - ➢ substantia nigra pars reticulata (SNr)



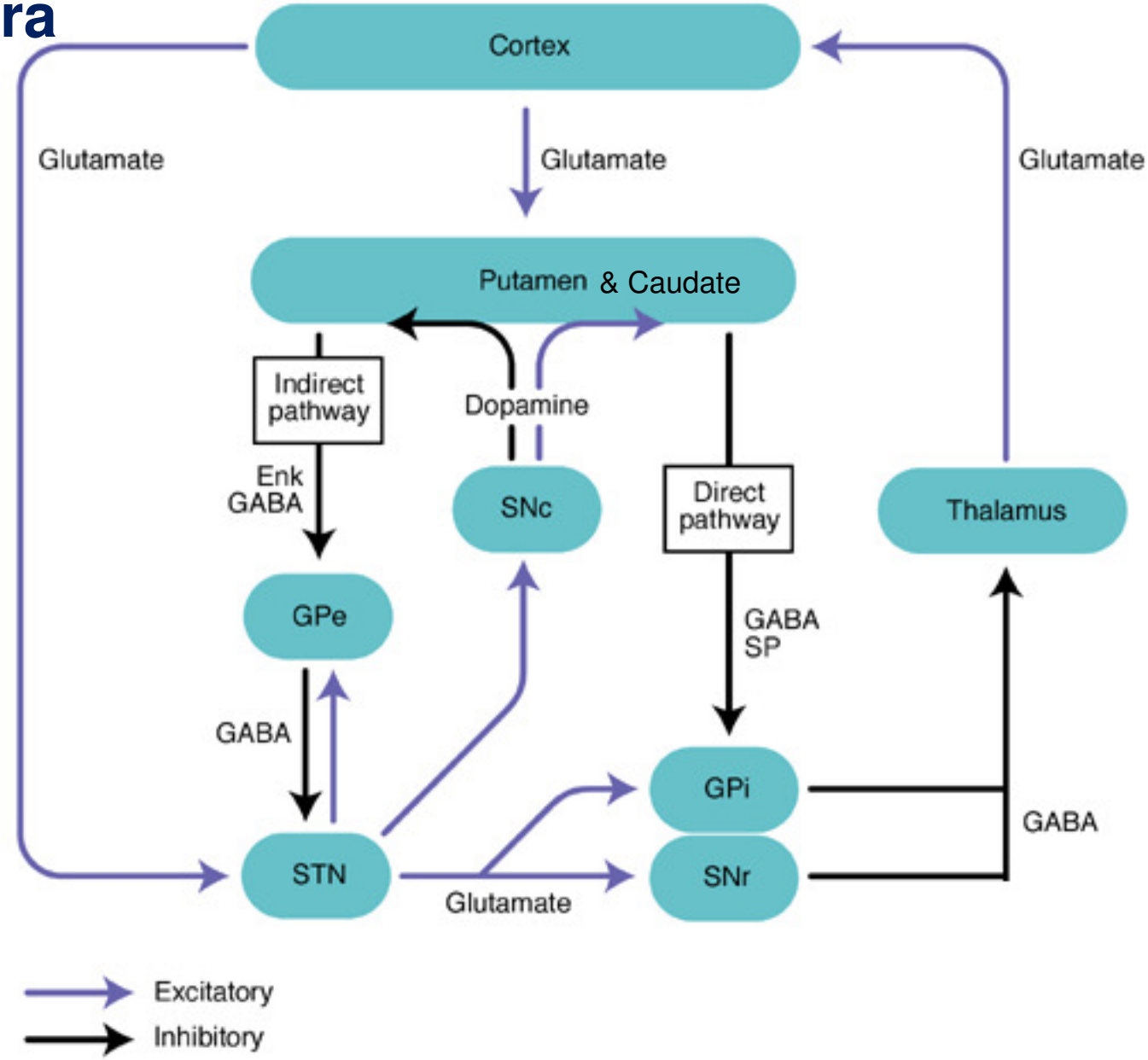
Indirect pathway

- Corticostriate Fibers (+)
- Striatopallidal (-)
- Pallidosubthalamic fibers (-)
- Subthalamopallidal fibers (+)
- Pallidothalamic fibers nigrothalamic fibers (-)
- Thalamocortical fibers (+)
- The net effect is to **decrease** the activity of the thalamus and the cerebral cortex



Role of Substantia nigra

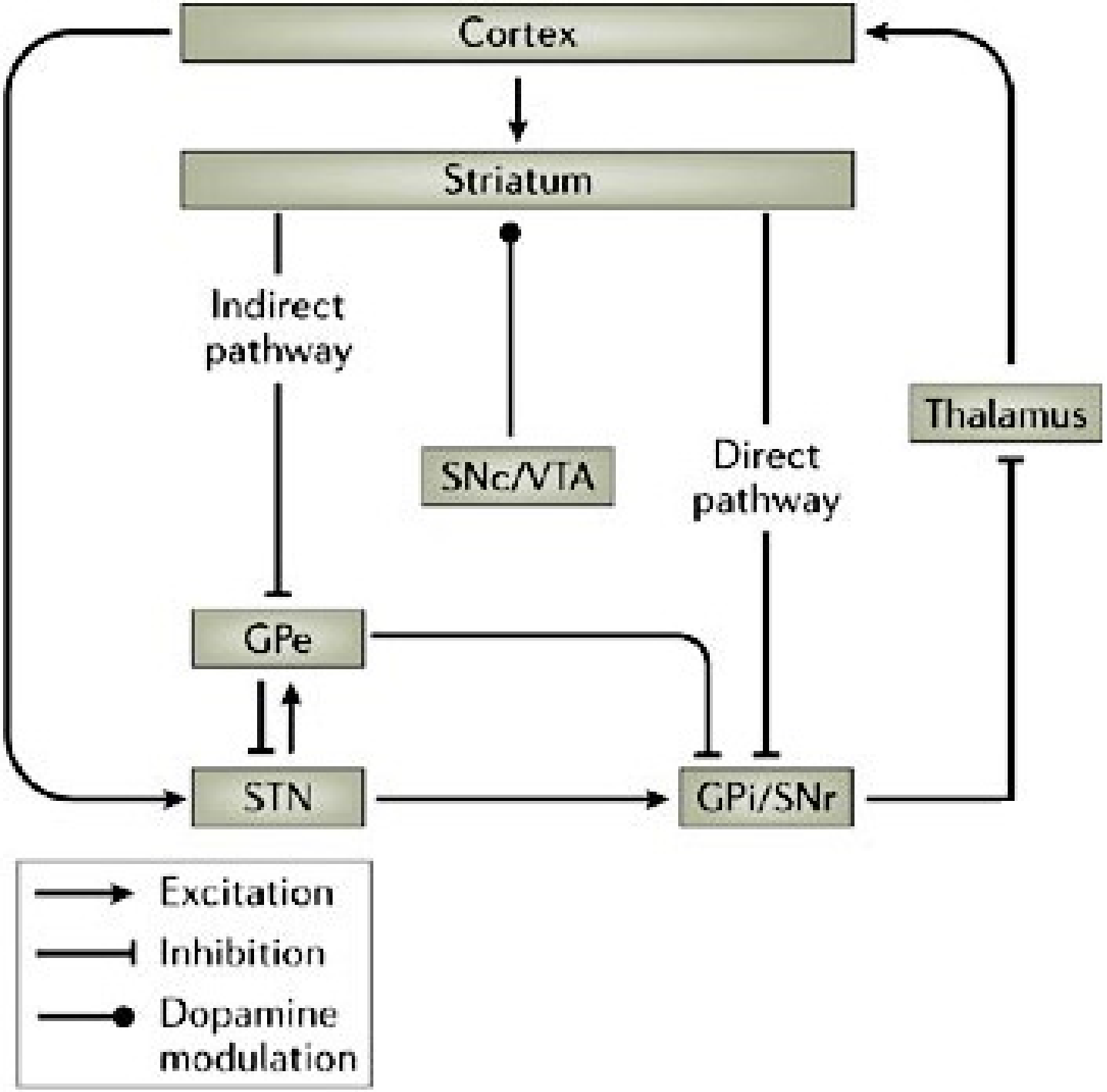
- Substantia nigra pars reticulata (SNr) functionally similar to GPi
- Substantia nigra pars Compacta (SNc)
  - Releases dopamine in neostriatum
  - Excitatory to direct pathway (D1 receptors)
  - Inhibitory to indirect pathway (D2 receptors)



➢ Note: Basal galglia receive no direct input from or output to the spinal cord.

Functions of basal ganglia

- Regulation of voluntary movement
- Learning of motor skills.
- Preparation for the movements by controlling the axial and girdle movements of the body



➢ ***Disinhibition is the Primary Mode of Basal Nuclear Function***

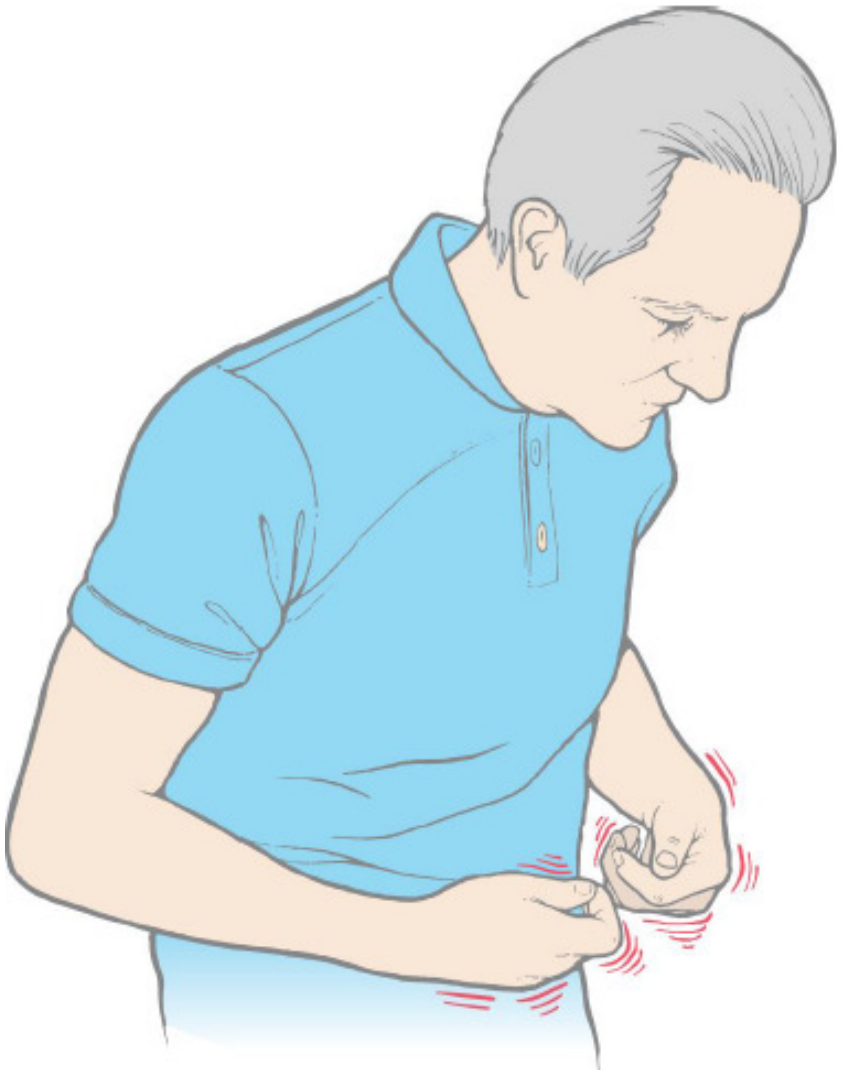
Parkinson Disease

- Progressive disease of unknown cause
- Neuronal degeneration in the **substantia nigra**
- Reduction in the release of the neurotransmitter dopamine within striatum
- signs and symptoms:

➢ **Tremor**
  - slow and occurs most obviously when the limbs are at rest

➢ **Rigidity**
  - present to an equal extent in opposing muscle groups

➢ **Bradykinesis**
  - difficulty in initiating (**akinesia) and** performing new movements

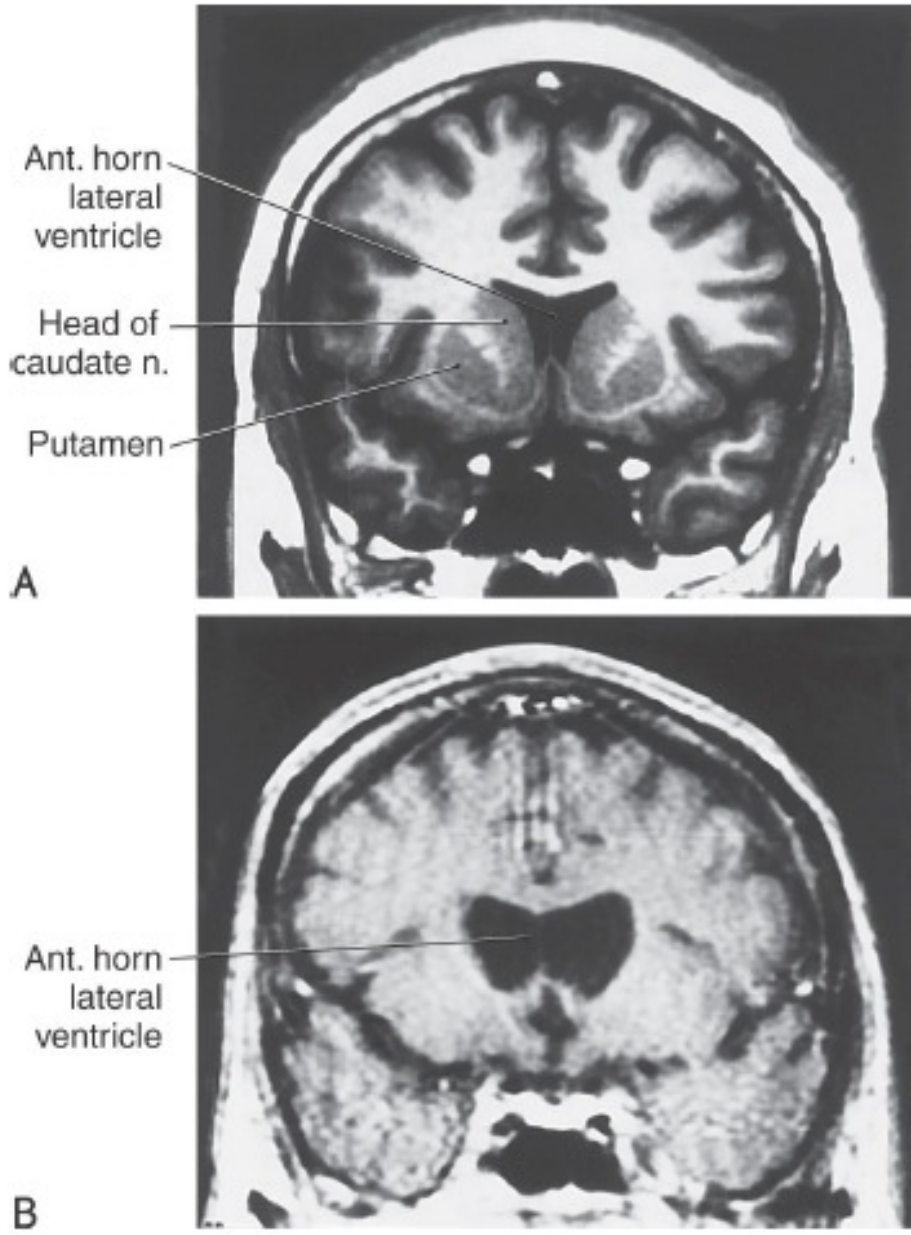


Huntington disease

- Inherited disease, single gene defect on chromosome 4.
- Degeneration of the **striatonigral-inhibiting pathway**.
- This results in the dopa-secreting neurons of the substantia nigra becoming overactive; thus, the nigrostriatal pathway inhibits the caudate nucleus and the putamen
- Signs and symptoms:

1- **Choreiform movements:** first appear as involuntary movements of the extremities and twitching of the face (facial grimacing). Later, patient becomes immobile and unable to speak or swallow.

2- **Progressive dementia:** occurs with loss of memory and intellectual capacity.



➢ Computed tomography scans show enlarged lateral ventricles due to degeneration of the caudate nuclei.