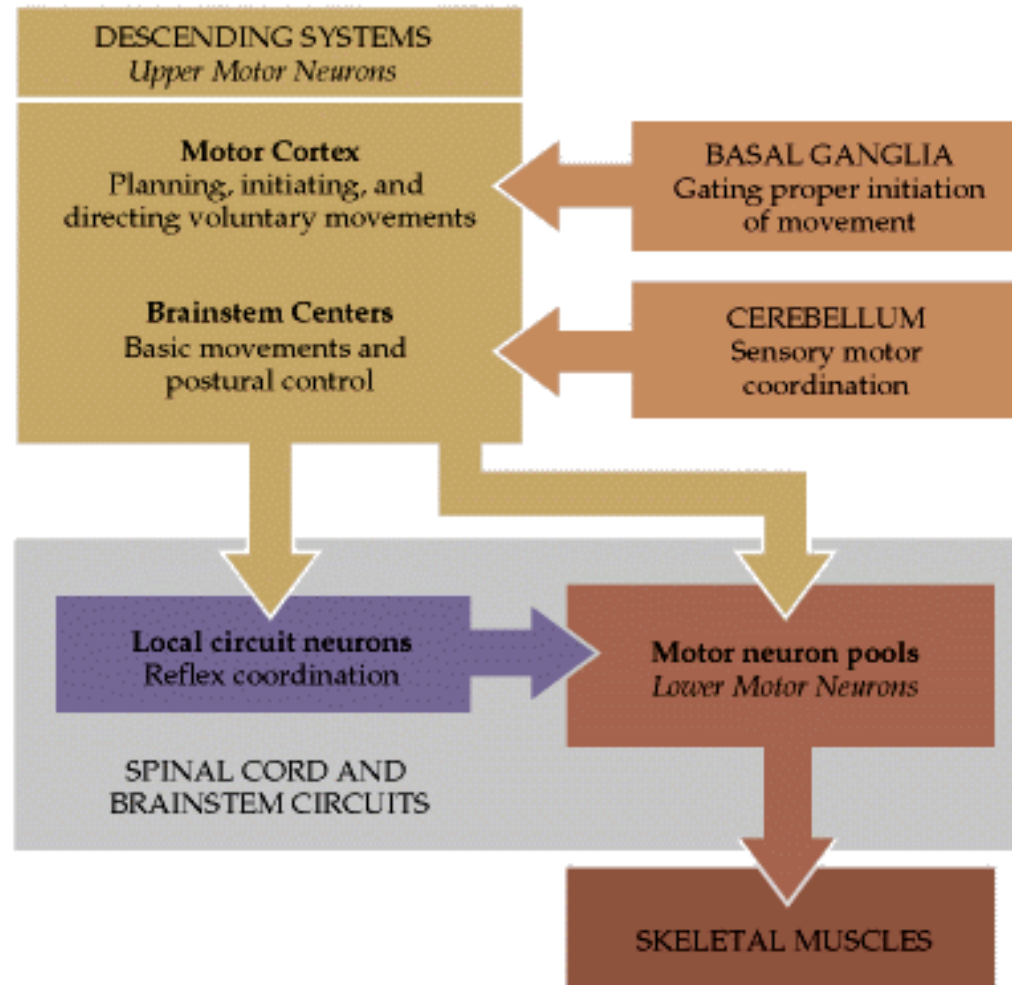


14

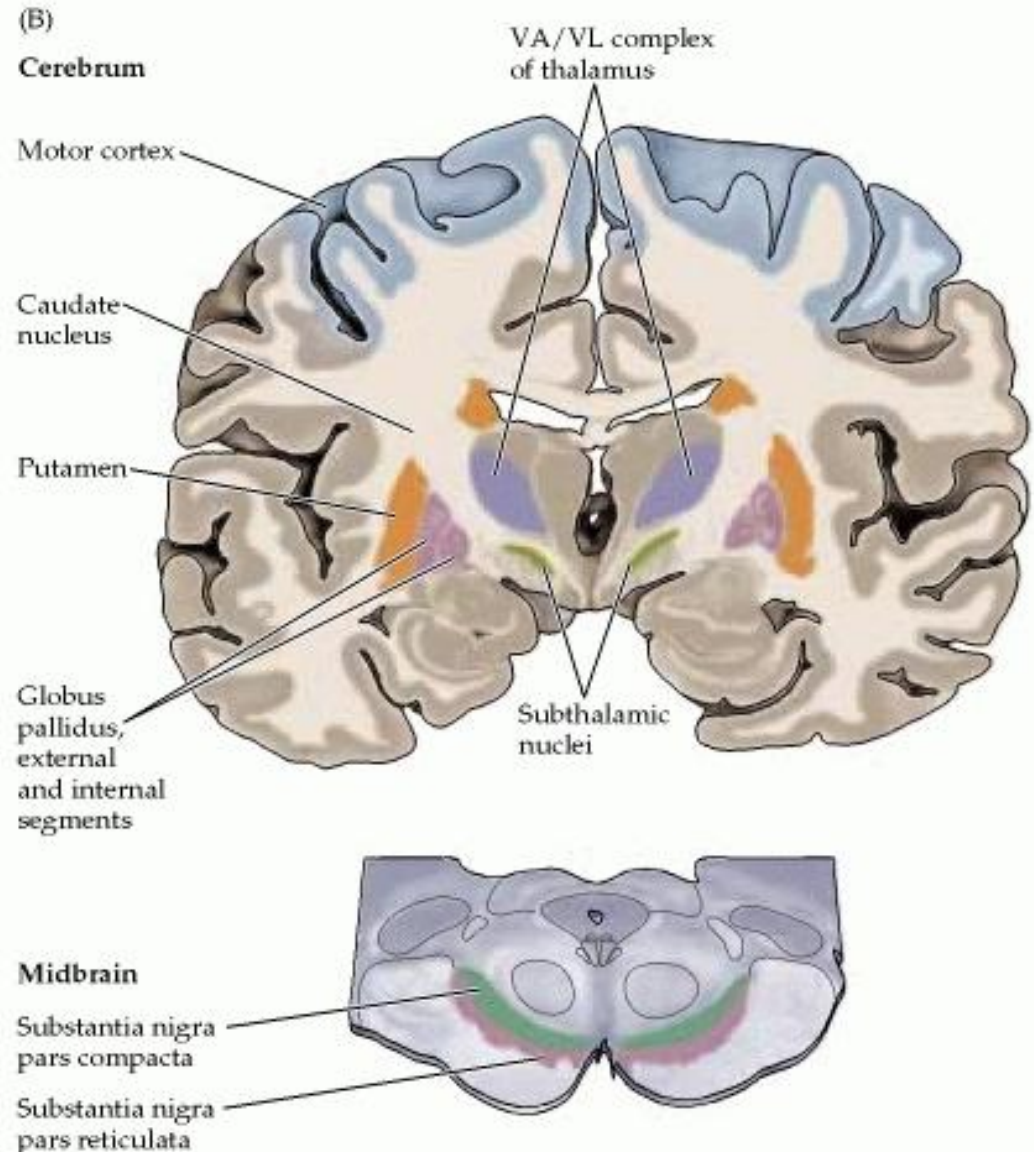
Motor system III

Hierarchic organization of motor system



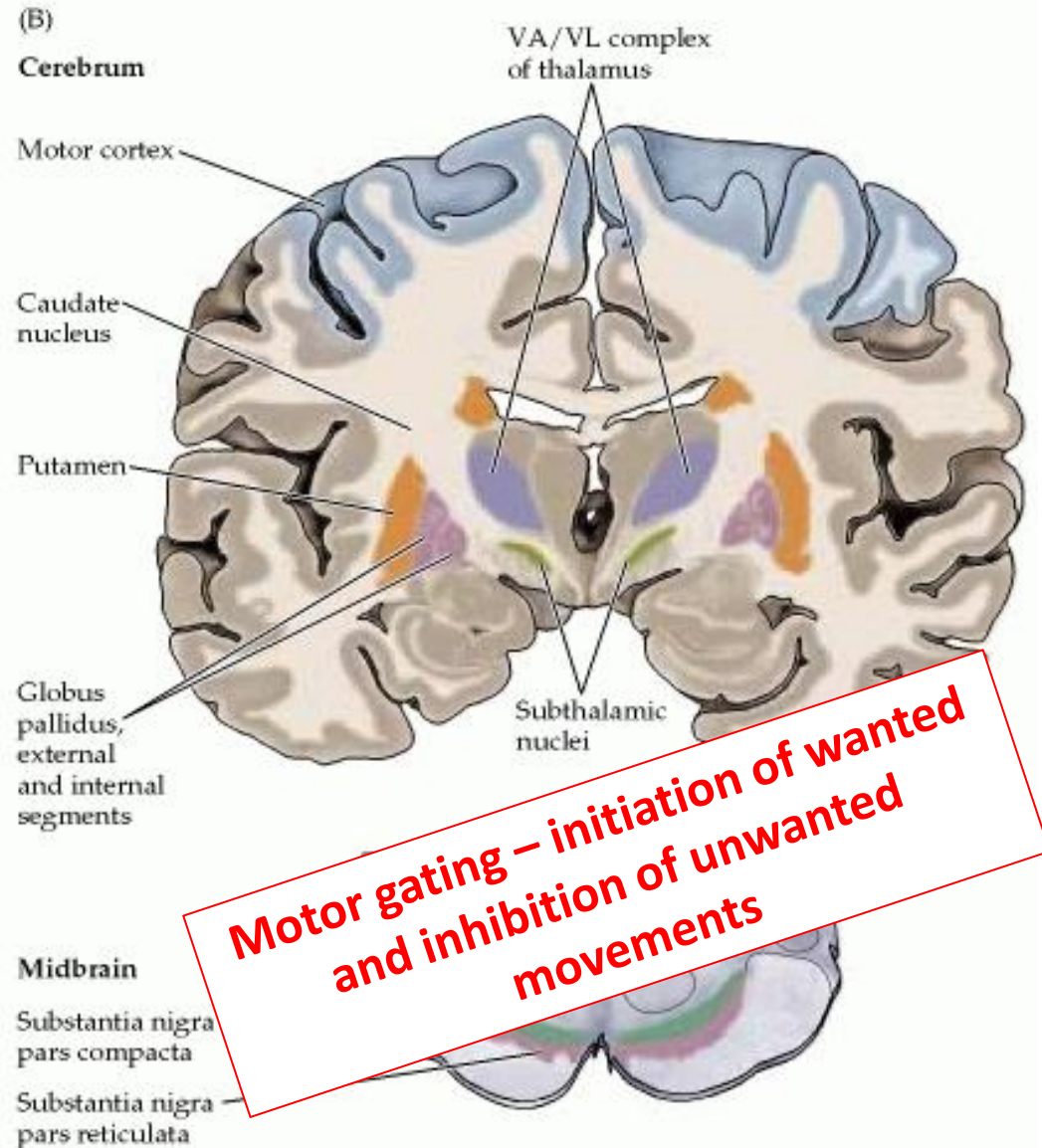
Basal ganglia

- Corpus striatum
 - Nucleus caudatus
 - Putamen
- Globus pallidus (Pallidum)
 - Externum
 - Internum
- Nucleus subthalamicus
- Substantia nigra
 - Pars compacta
 - Pars reticulata
- Thalamic motor nuclei



Basal ganglia

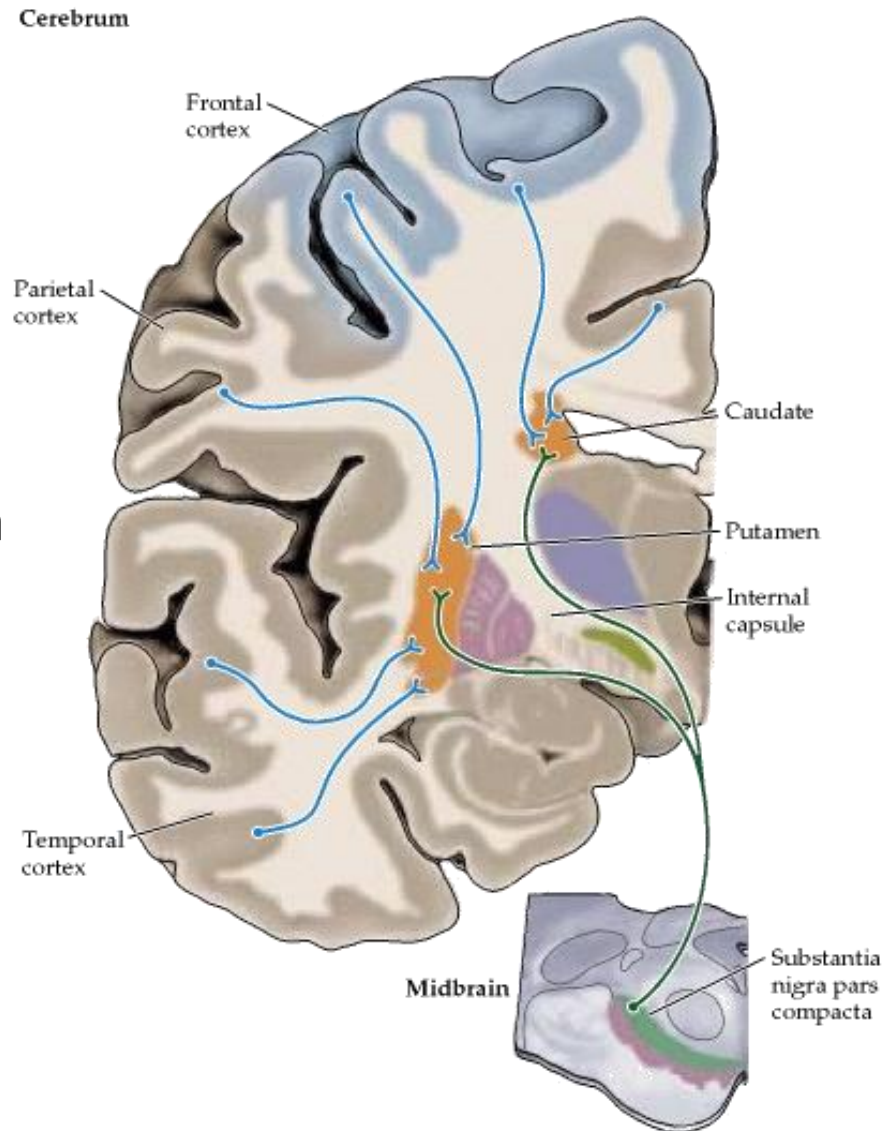
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- Thalamic motor nuclei



Basal ganglia - inputs

Corpus striatum

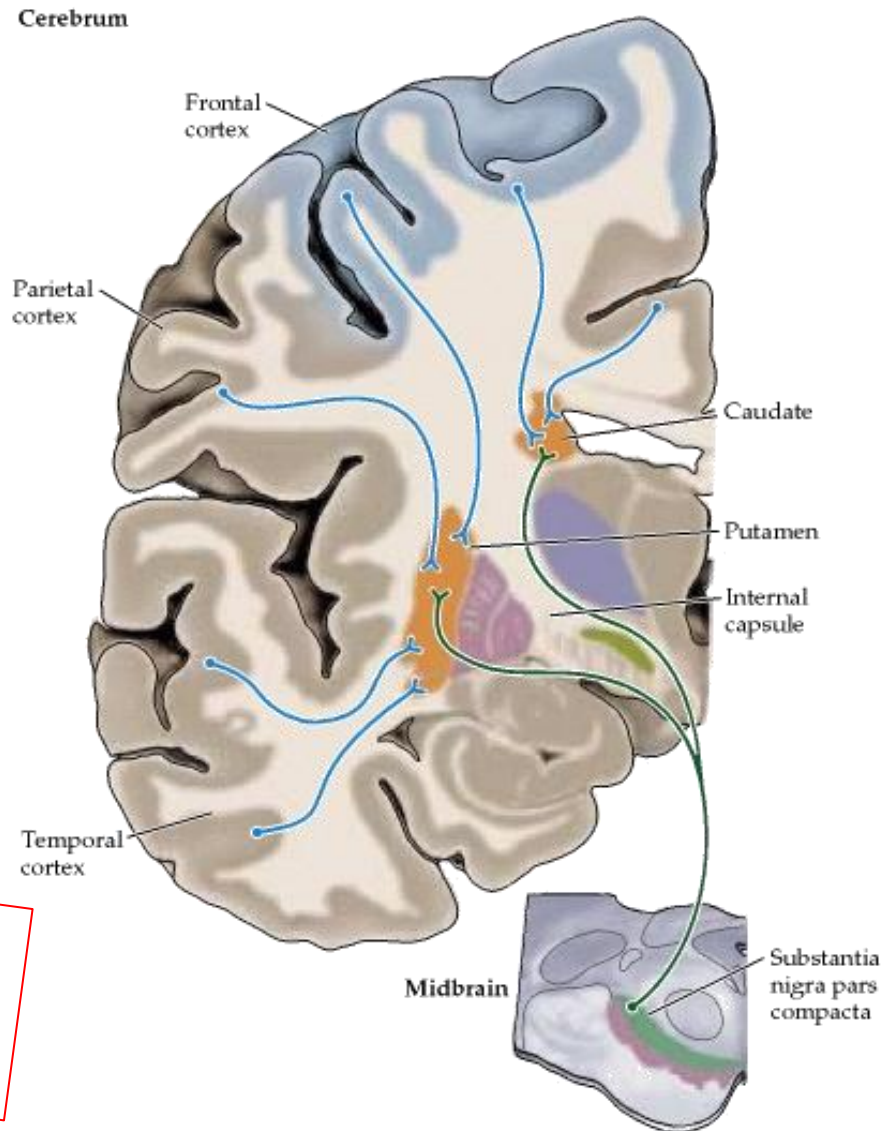
- Connections from all cortical areas with two exceptions – primary visual and primary auditory cortex
- The most of connections from
 - Frontal and parietal association areas
 - Motor areas



Basal ganglia - inputs

Corpus striatum

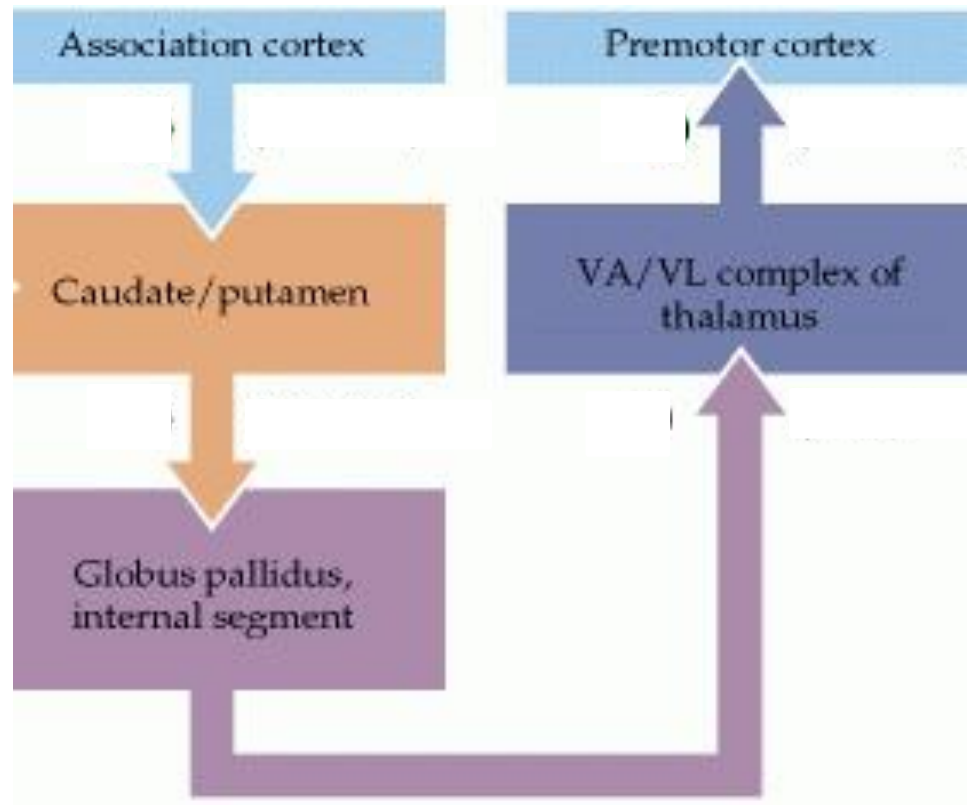
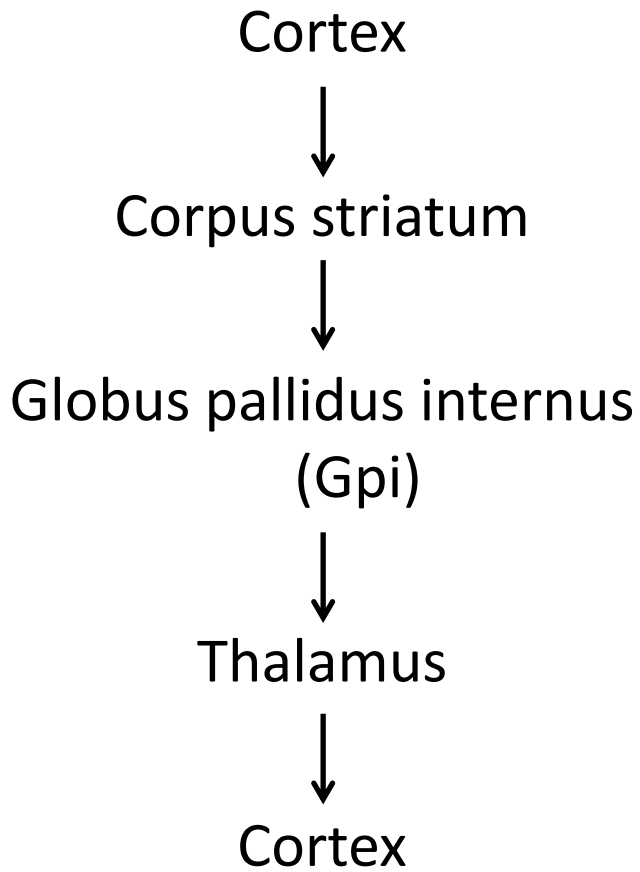
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Basal ganglia

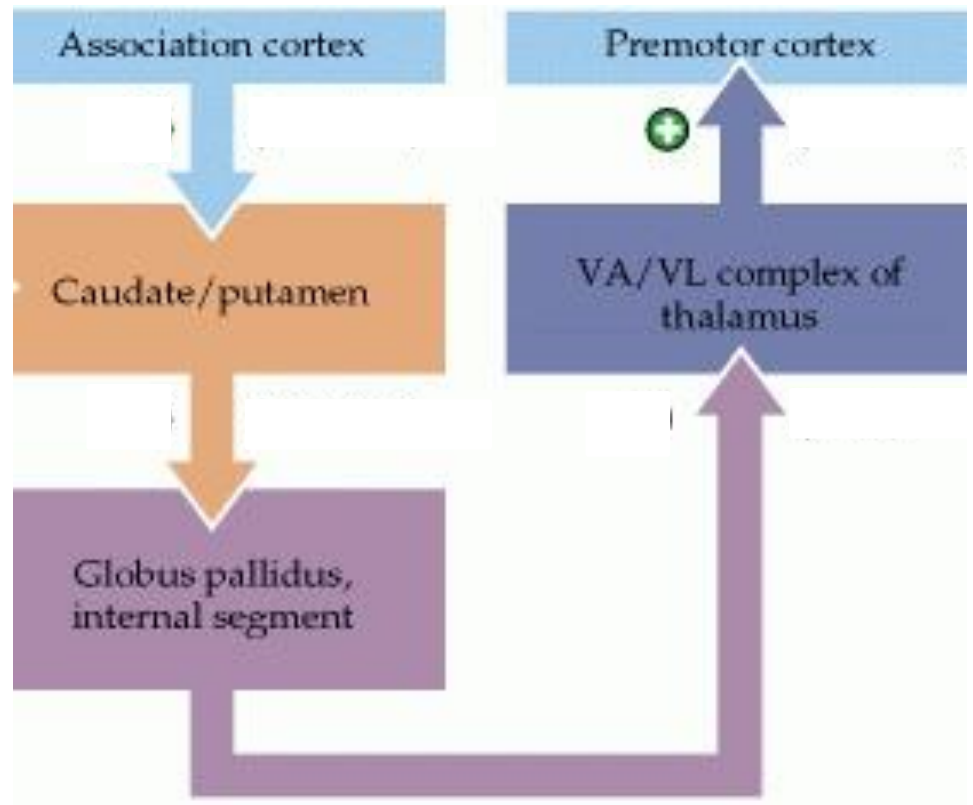
- Motor control realized by two circuits
 - Direct pathway
 - Motor cortex activation
 - Indirect pathway
 - Motor cortex inhibition

Direct pathway



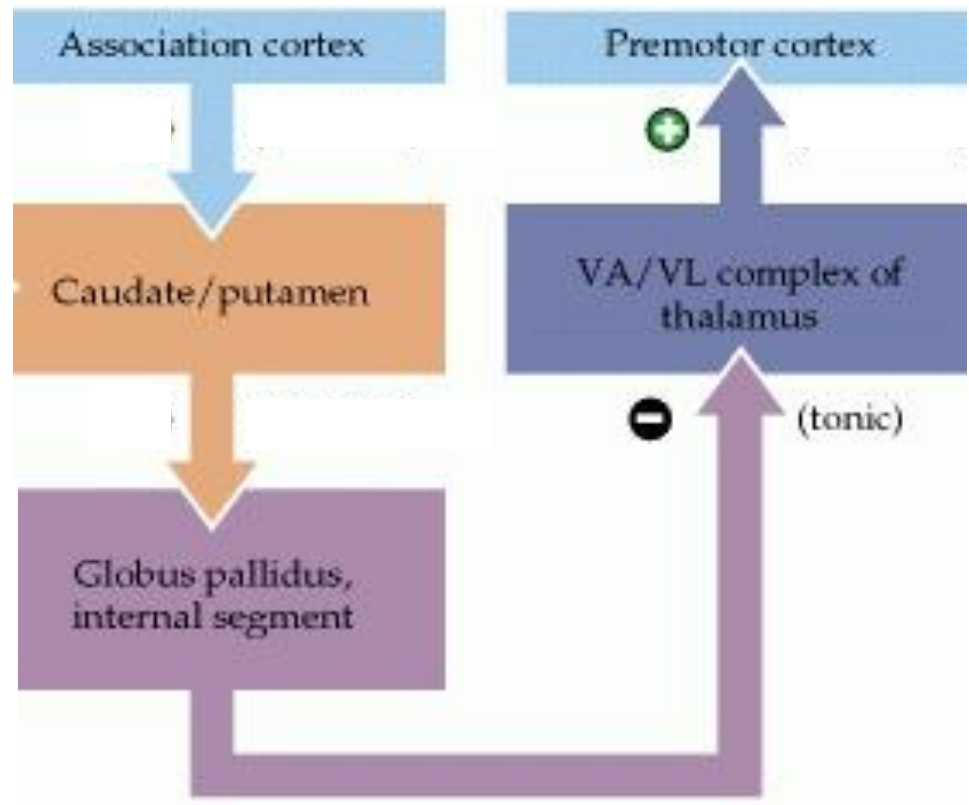
Direct pathway

- Thalamic motor nuclei activate motor cortex



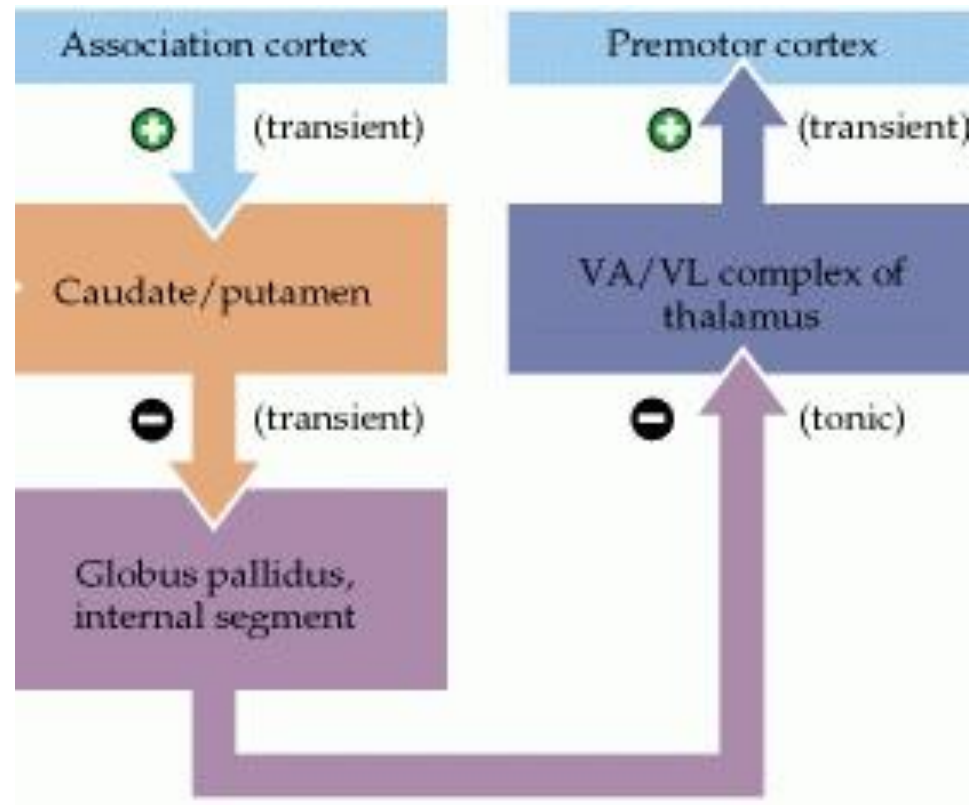
Direct pathway

- Thalamic motor nuclei activate motor cortex
- Tonic inhibitions of thalamic motor nuclei by GPi

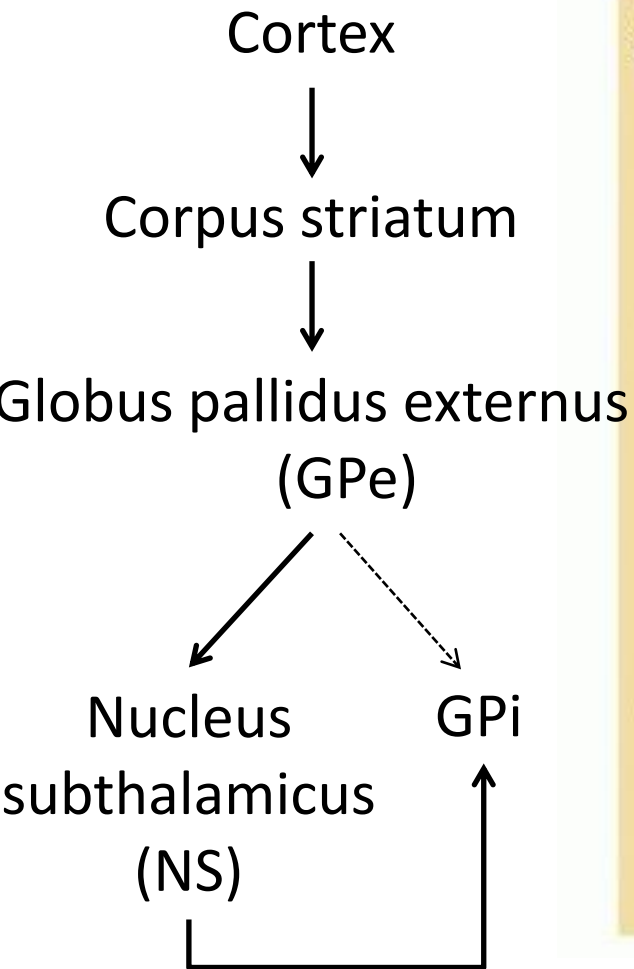


Direct pathway

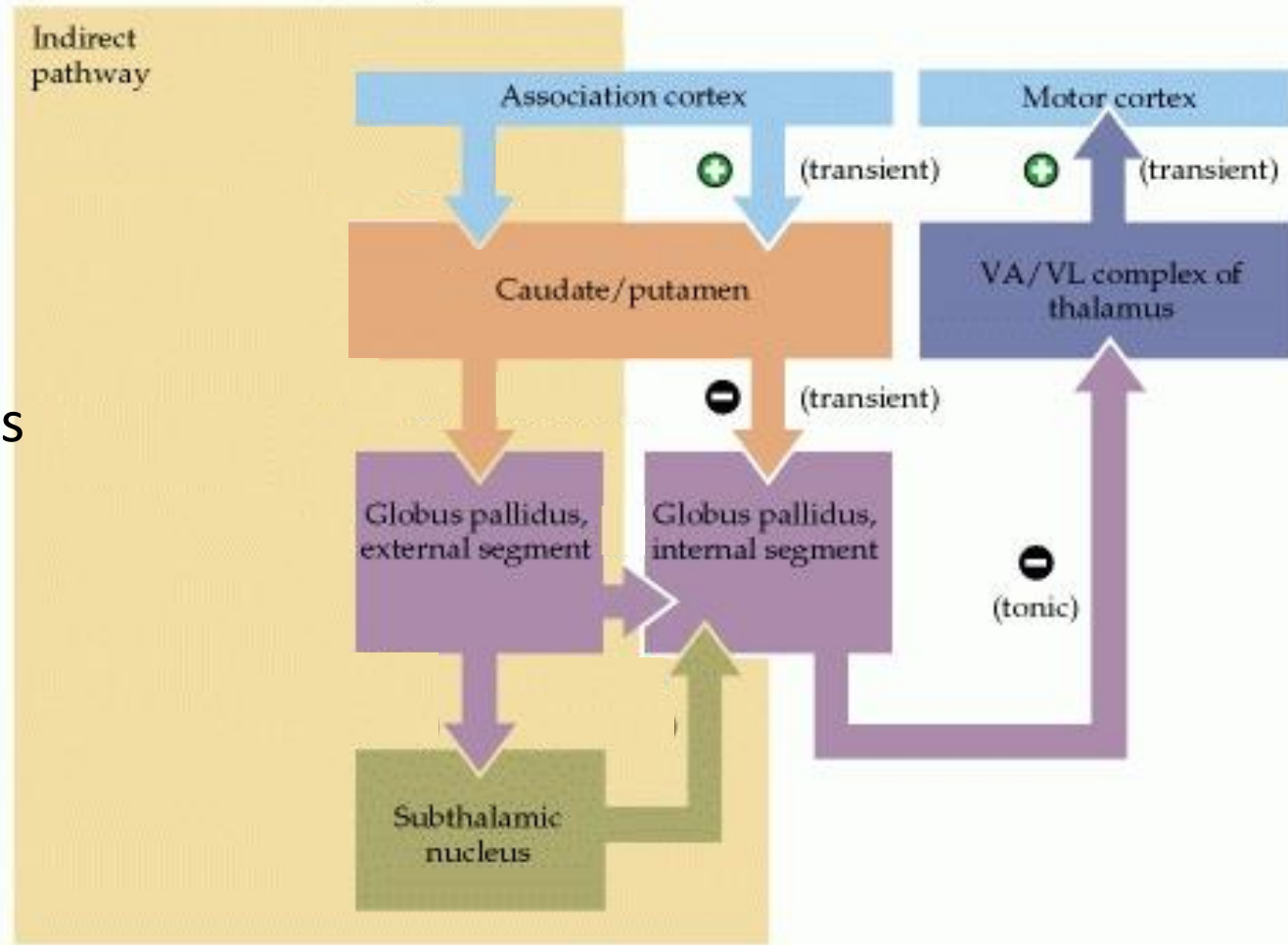
- Thalamic motor nuclei activate motor cortex
- Tonic inhibitions of thalamic motor nuclei by GPI
- Activated corpus striatum transiently inhibits Gpi, resulting in transient disinhibition of thalamic motor nuclei



Indirect pathway

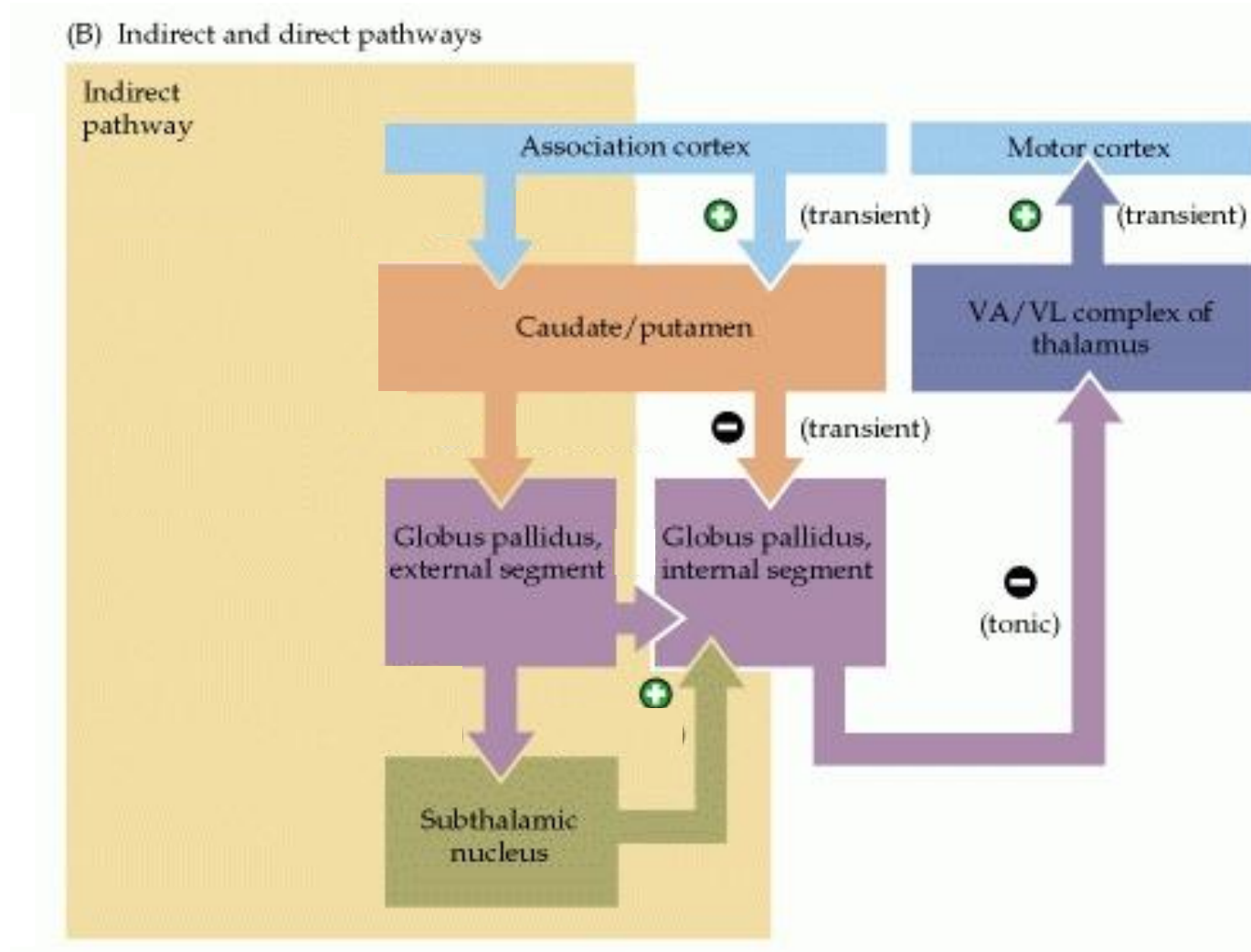


(B) Indirect and direct pathways



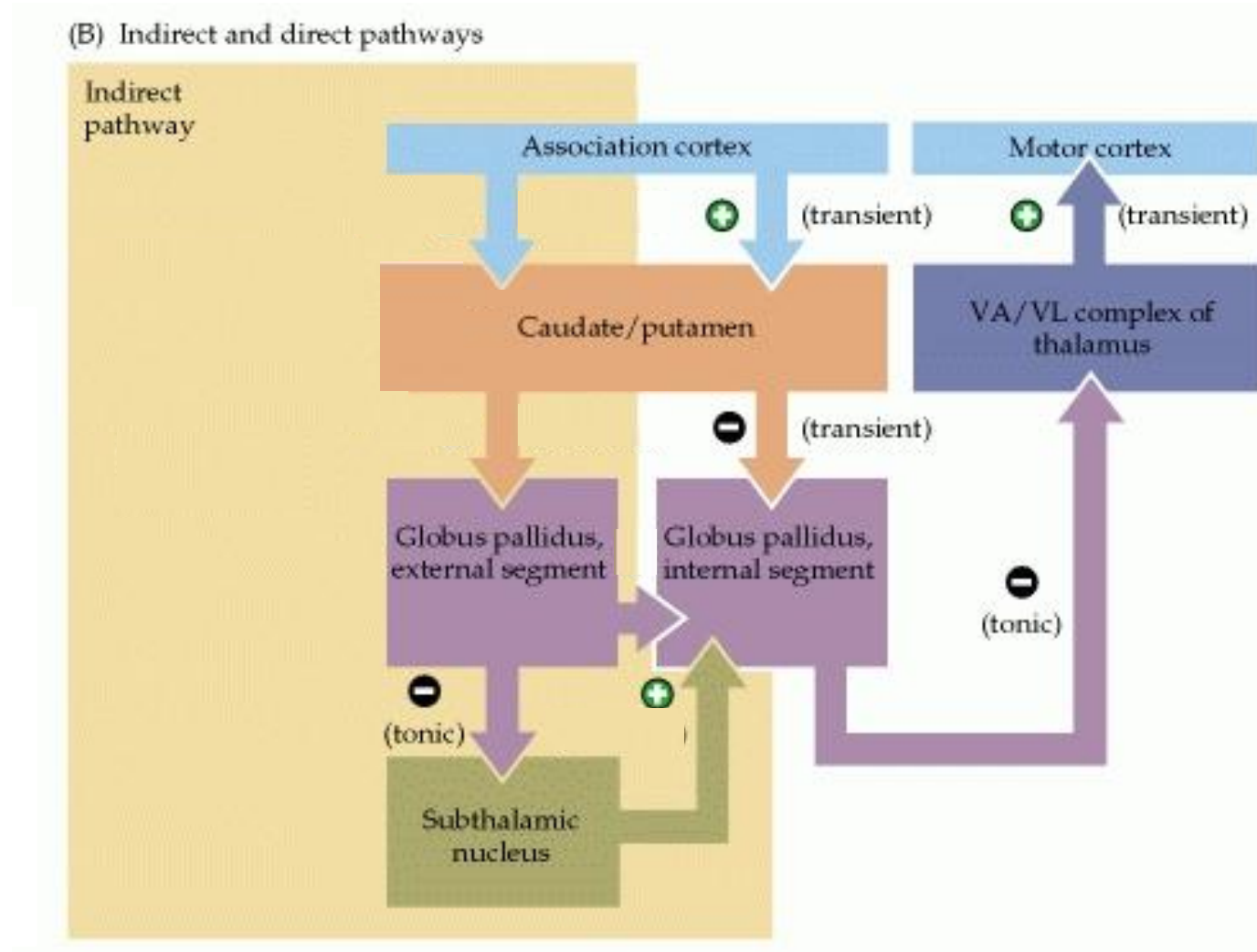
Indirect pathway

- NS activates GPi



Indirect pathway

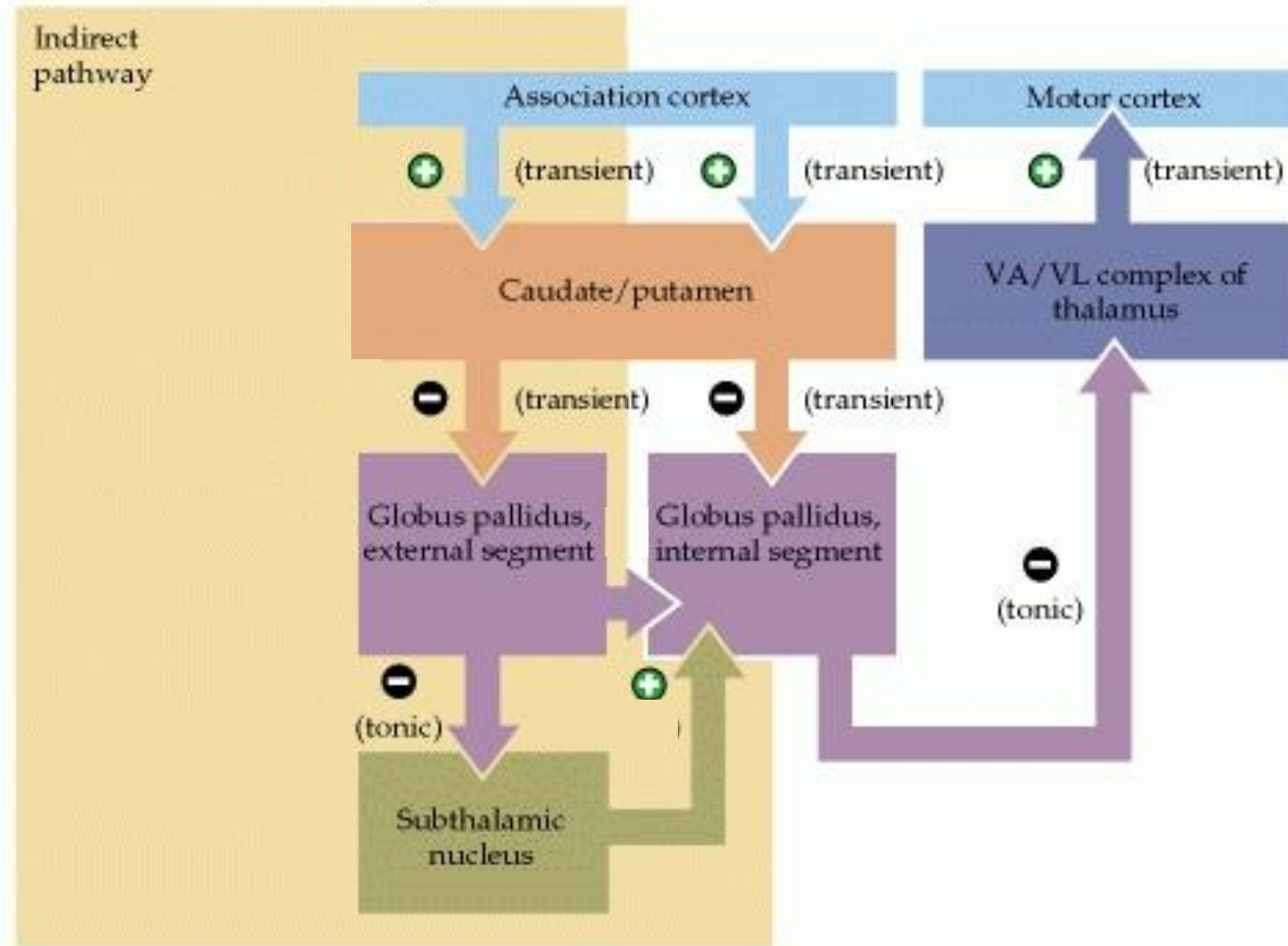
- NS activates GPi
- GPe tonically inhibits NS



Indirect pathway

- NS activates GPi
- GPe tonically inhibits NS
- Corpus striatum transiently inhibits GPe

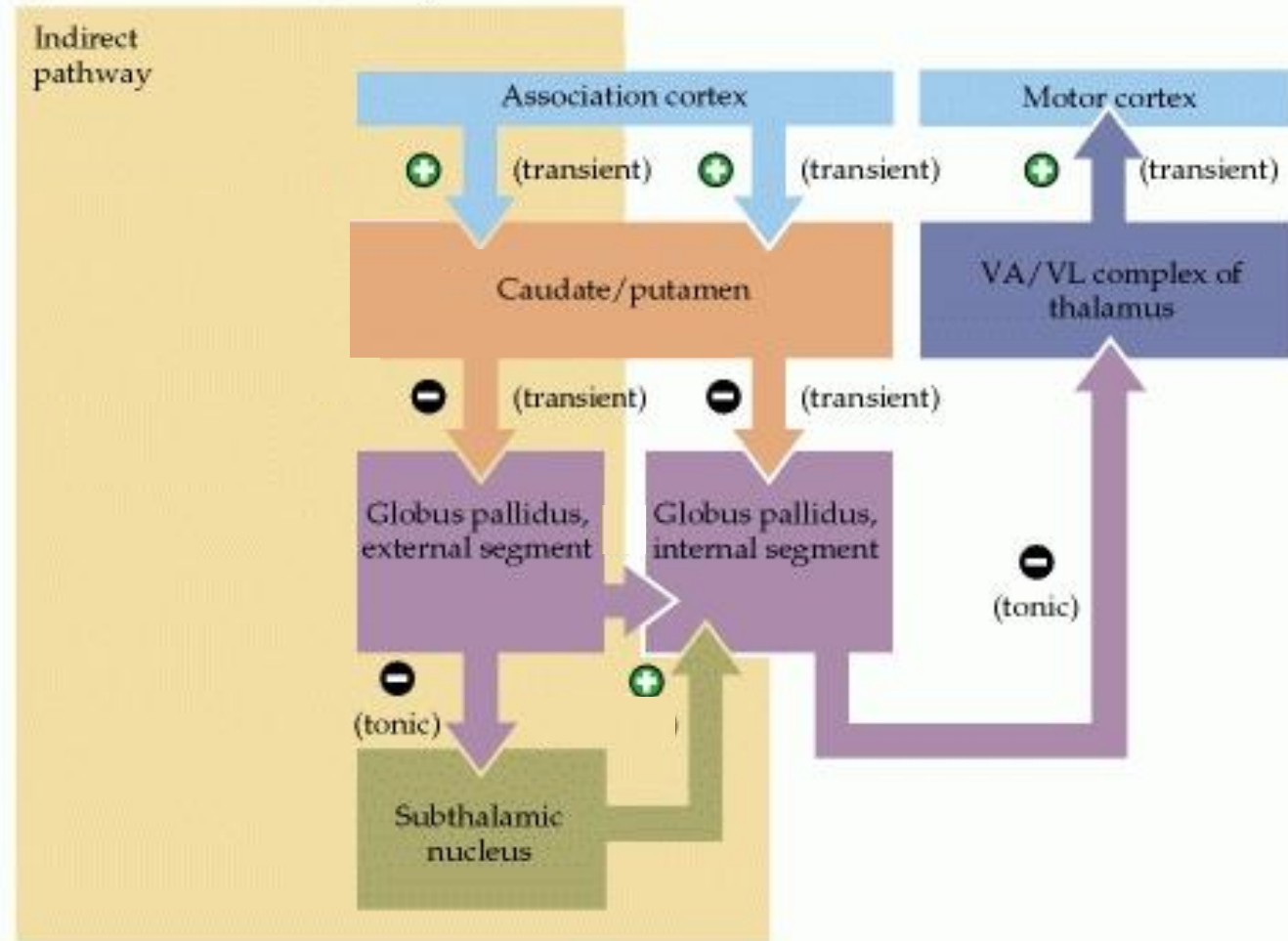
(B) Indirect and direct pathways



Indirect pathway

- NS activates GPi
 - GPe tonically inhibits NS
 - Corpus striatum transiently inhibits GPe
- ↓
- NS disinhibition

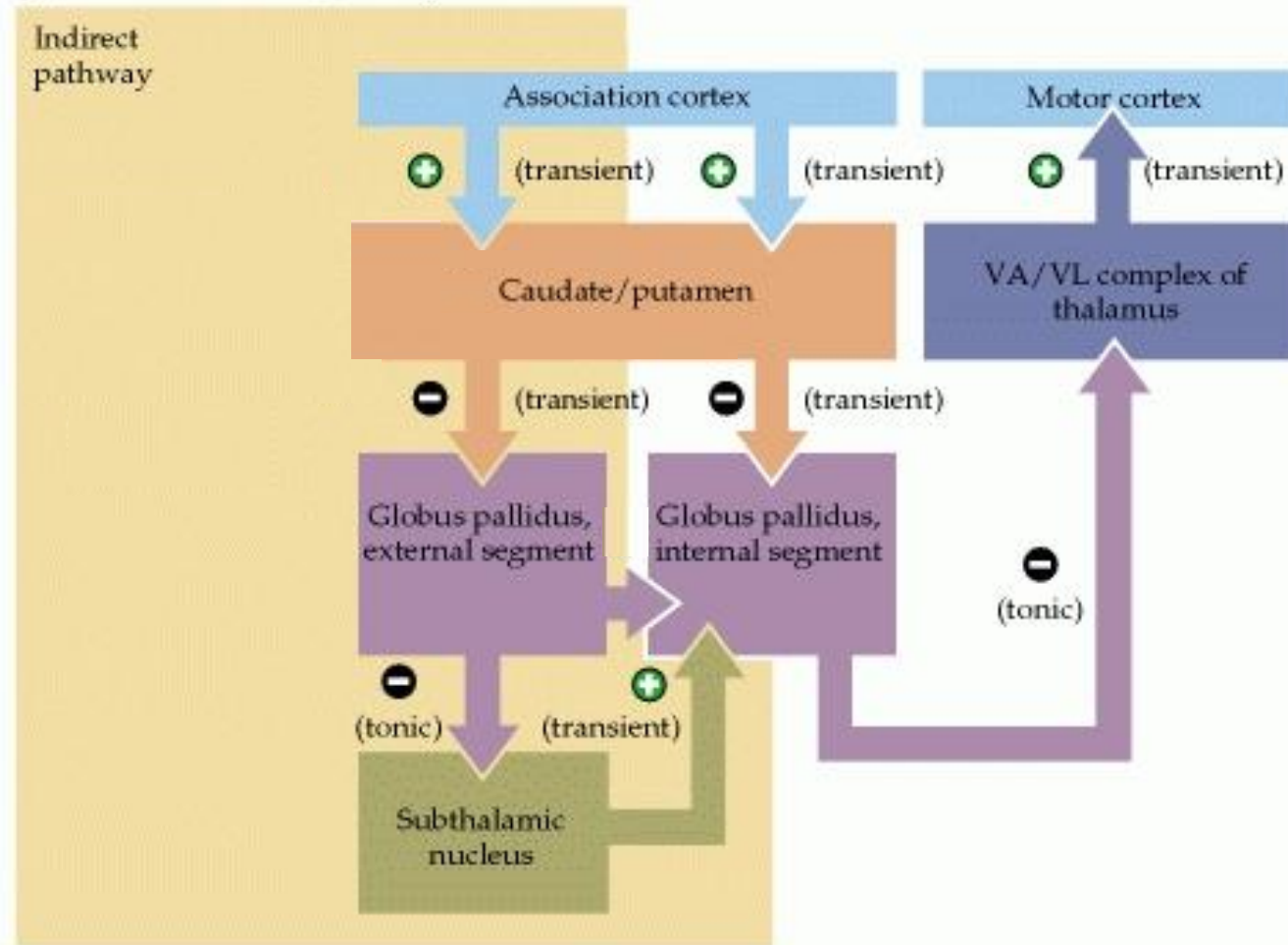
(B) Indirect and direct pathways



Indirect pathway

- NS activates GPi
 - GPe tonically inhibits NS
 - Corpus striatum transiently inhibits GPe
- ↓
- NS disinhibition
- ↓
- Gpi activation

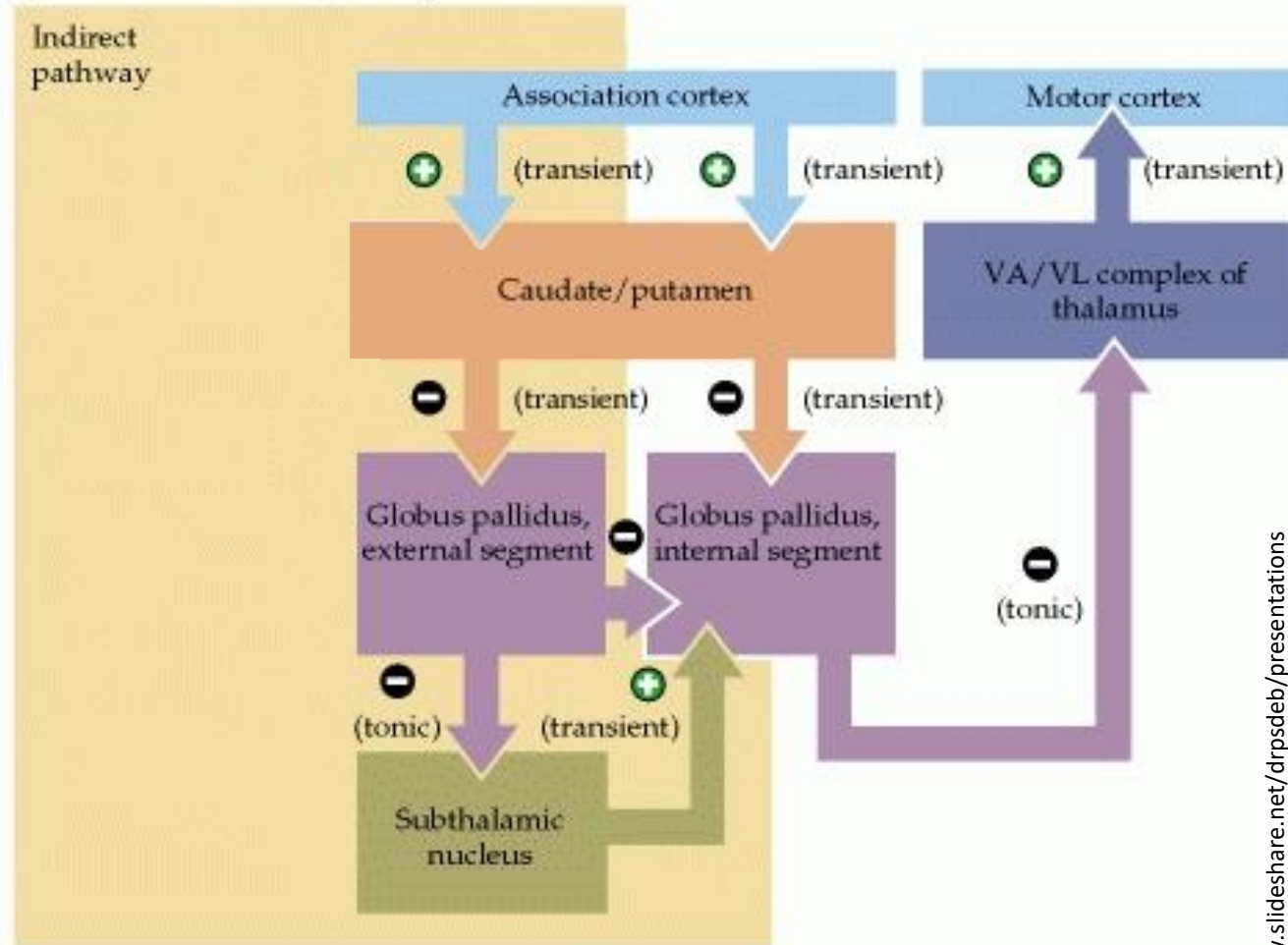
(B) Indirect and direct pathways



Indirect pathway

- NS activates GPi
 - GPe tonically inhibits NS
 - Corpus striatum transiently inhibits GPe
- ↓
- NS disinhibition
- ↓
- Gpi activation

(B) Indirect and direct pathways

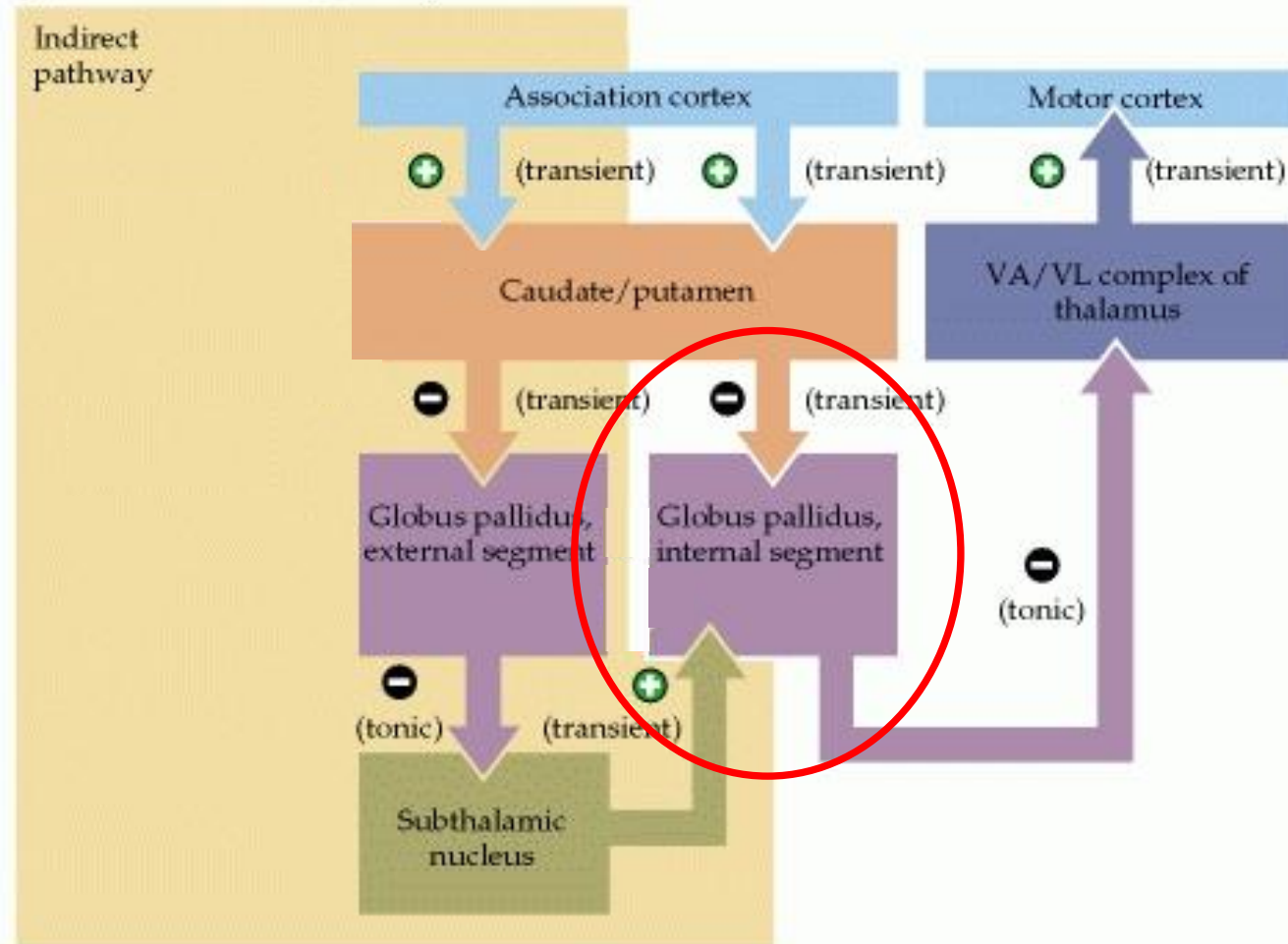


- Less important is a direct inhibition of Gpi by GPe

Direct and indirect pathway differences

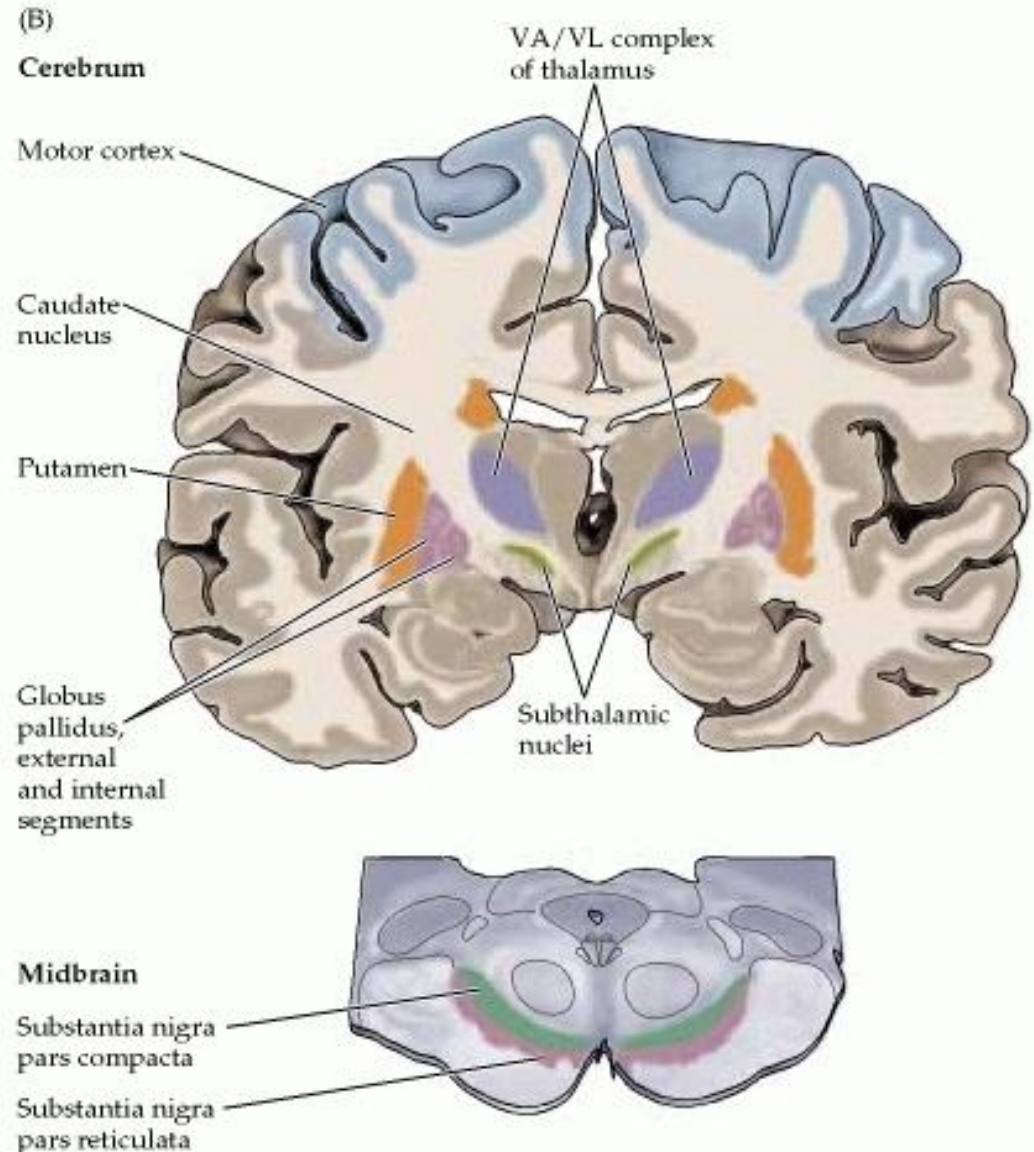
- Direct pathway
 - Motor cortex activation
- Indirect pathway
 - Motor cortex inhibition

(B) Indirect and direct pathways



Basal ganglia

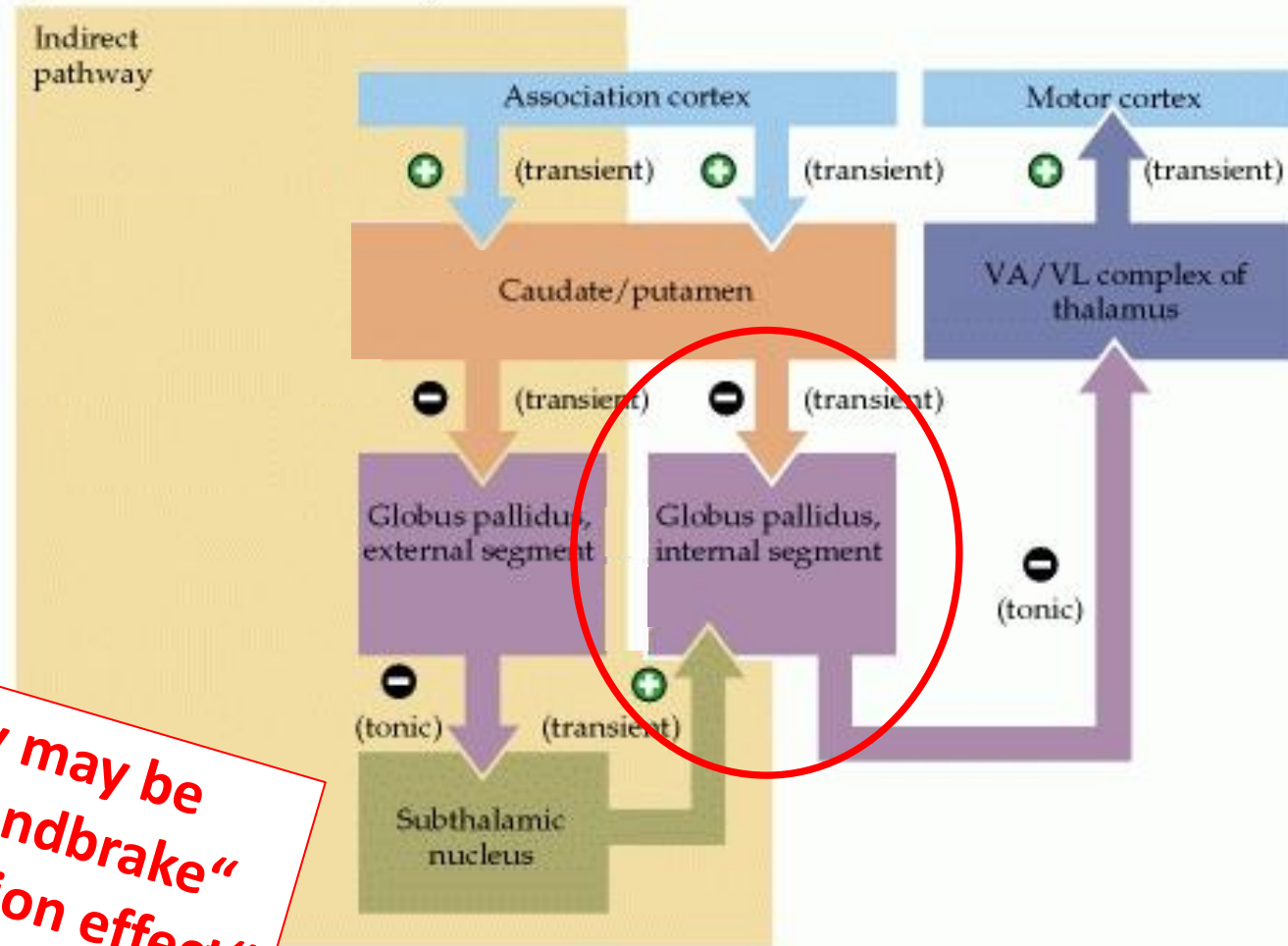
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- Thalamic motor nuclei



Direct and indirect pathway differences

- Direct pathway
 - Motor cortex activation
- Indirect pathway
 - Motor cortex inhibition

(B) Indirect and direct pathways

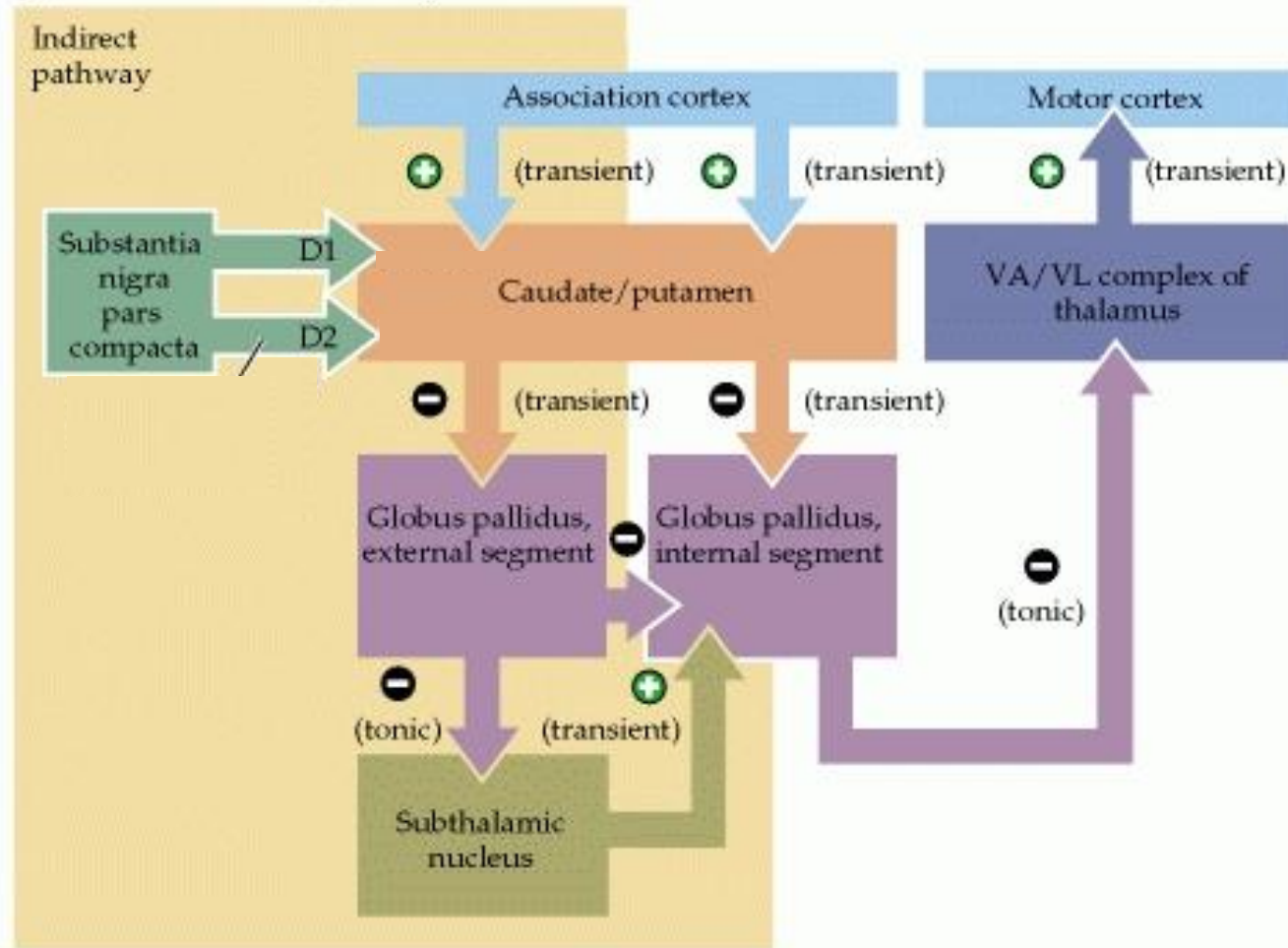


Indirect pathway may be considered as a „handbrake“ regulating „acceleration effect“ of the direct pathway

Dopaminergic projections

- Dopaminergic projections are crucial for the function of corpus striatum
- S. nigra pars compacta

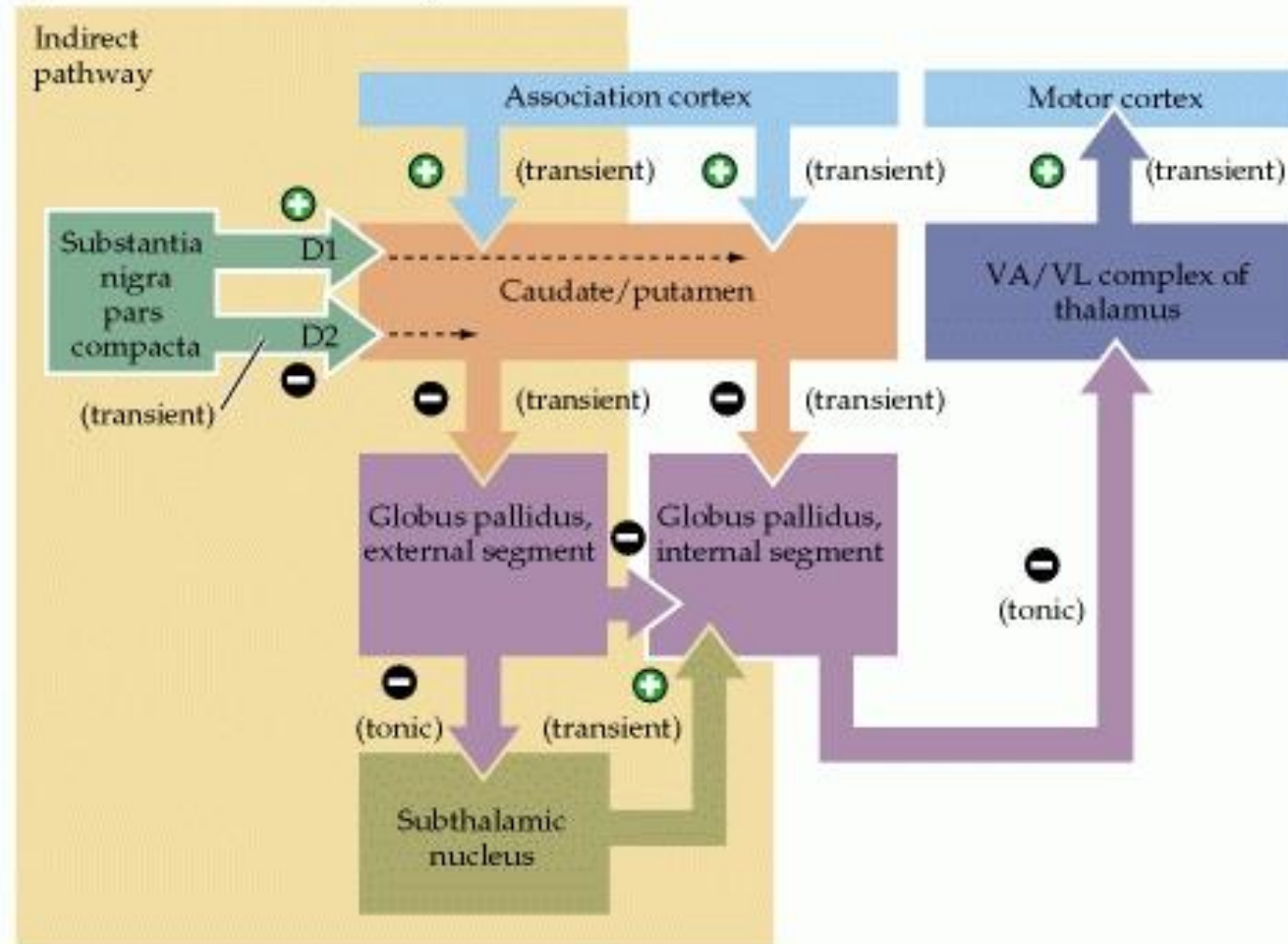
(B) Indirect and direct pathways



Dopaminergic projections

- Dopaminergic projections are crucial for the function of corpus striatum
- S. nigra pars compacta
- Direct pathway activation
 - D1 receptors
- Indirect pathway inhibition
 - D2 receptors

(B) Indirect and direct pathways

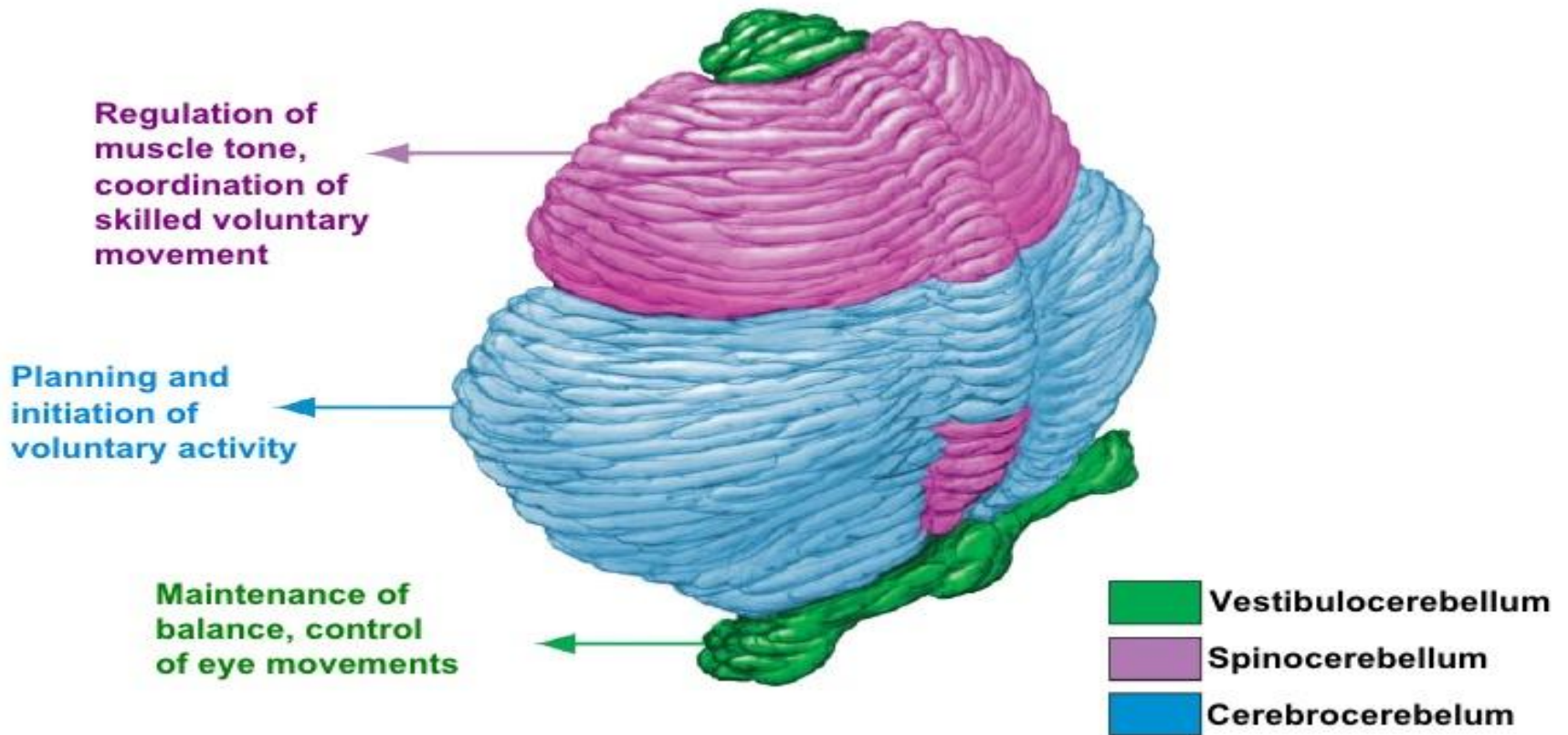


Basal ganglia

- Beside motor loop there are other loops associated with other thalamic nuclei
- „Gating“ of the other sort of information
- Association loop
- Limbic loop
- Basal ganglia play an important role in information processing in general and this is crucial for thinking process
- Connections of corpus striatum are plastic what allows learning and this was very important during evolution

Cerebellum

Coordination



Cerebellum

Cerebellum plays an important role not only in the coordination of movement, but also in the "coordination" of thoughts