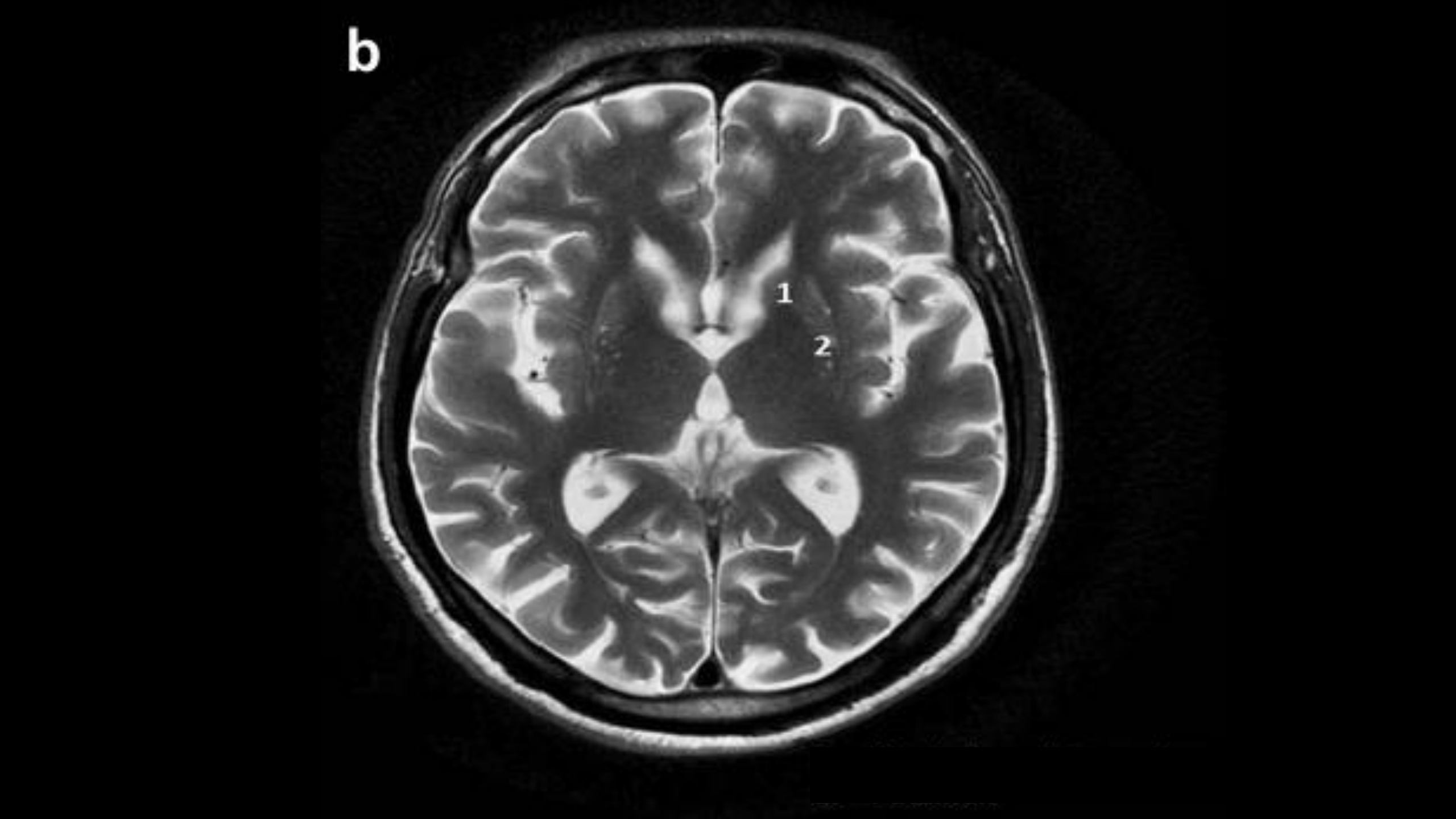
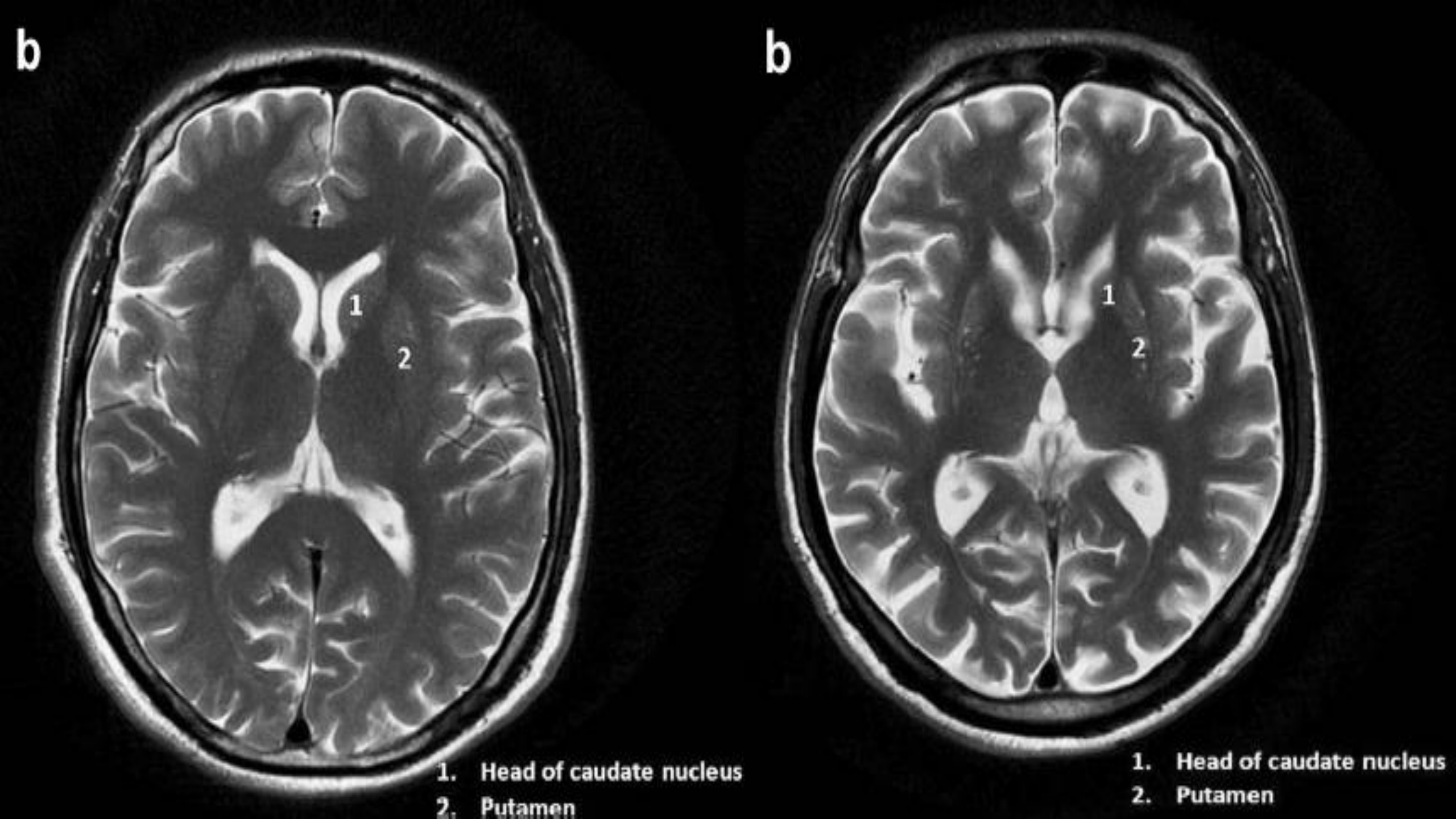
Núcleos de la Base

Nelson D. Villalba M.D.

Una mujer de 43 años consulta por un cuadro clínico de 5 años de evolución de movimientos involuntarios, irregulares y sin un patron. Estos movimientos no se asocian con la postura. Al examen físico se aprecian movimientos de baja amplitud que afectan la porción distal de los miembros superiores, la cara y a lengua. Además de los problemas en el movimiento la paciente se ha quejado de tristeza, dificultadad para aprender cosas nuevas, dificultadd para organizars sus pensamientos y priorizar mientras realiza una tarea, dificultad para organizar sus ideas.


b
1
2

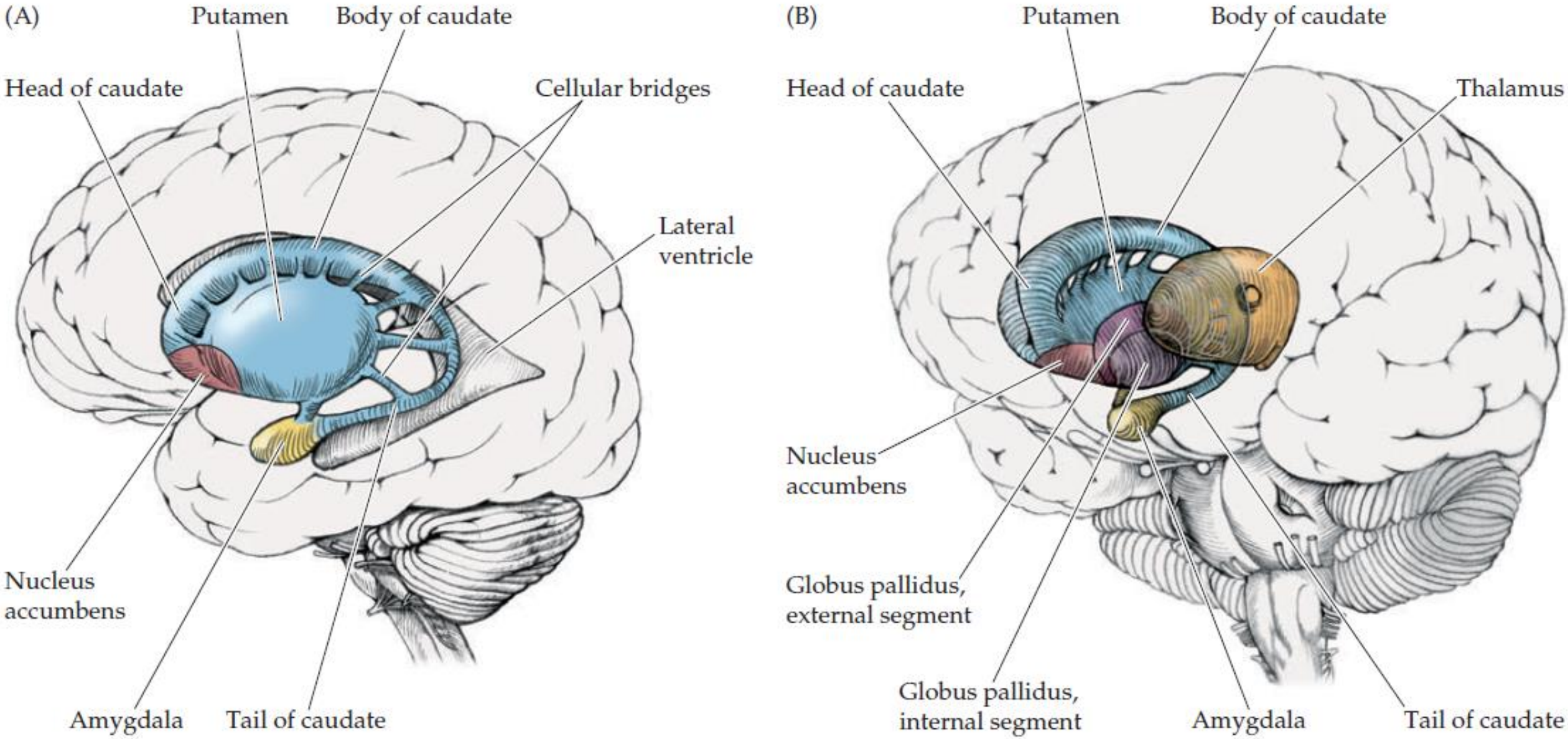

b
1
2
1. Head of caudate nucleus
2. Putamen
b
1
2
1. Head of caudate nucleus
2. Putamen

Núcleos de la Base

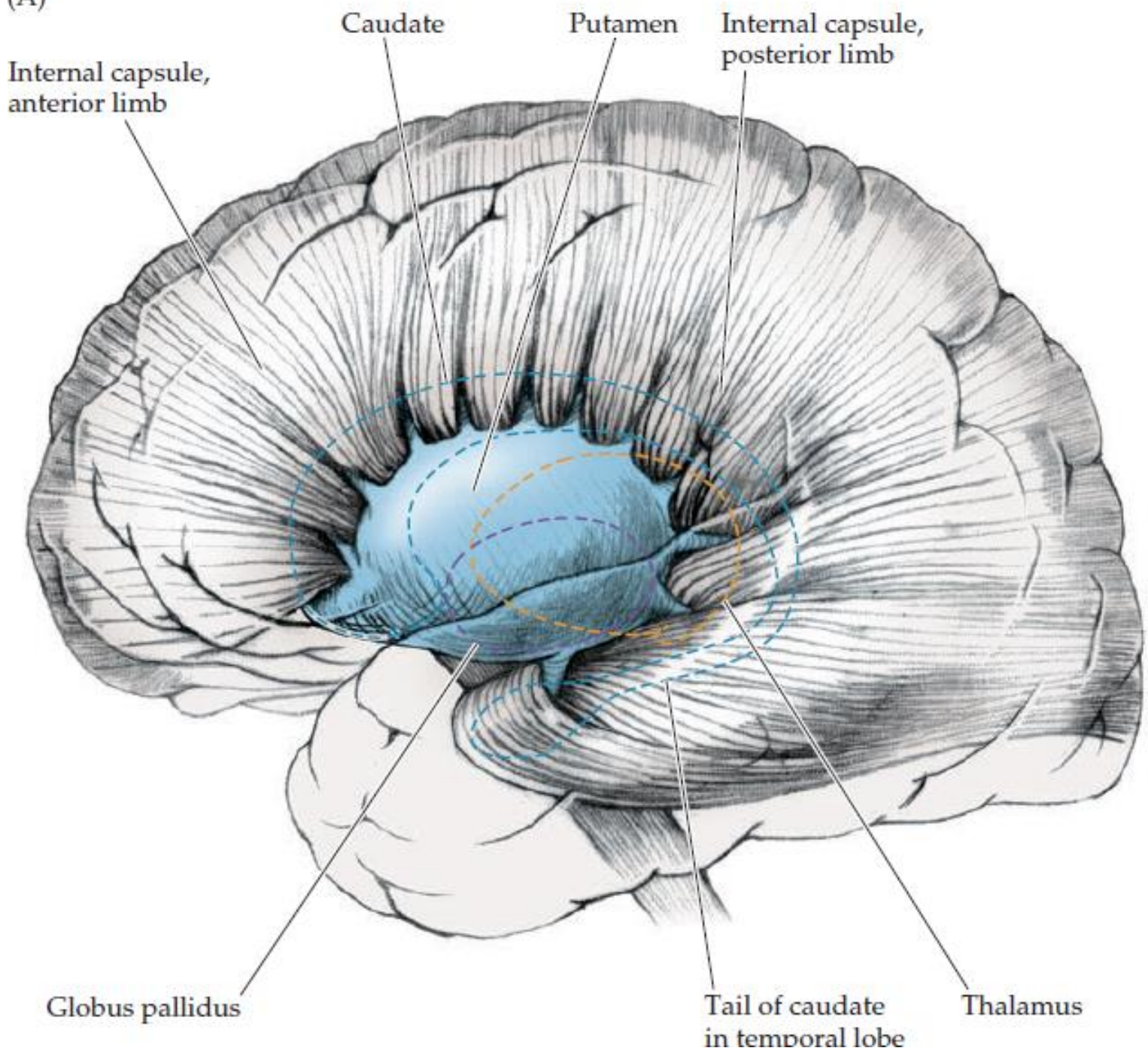
- Núcleo Caudado.
- Putamen .
- Globo Pálido (Interno – Externo).
- *Subtálamo (Diencefálico).*
- *Sustancia Negra pars Reticular (Mesencéfalo).*

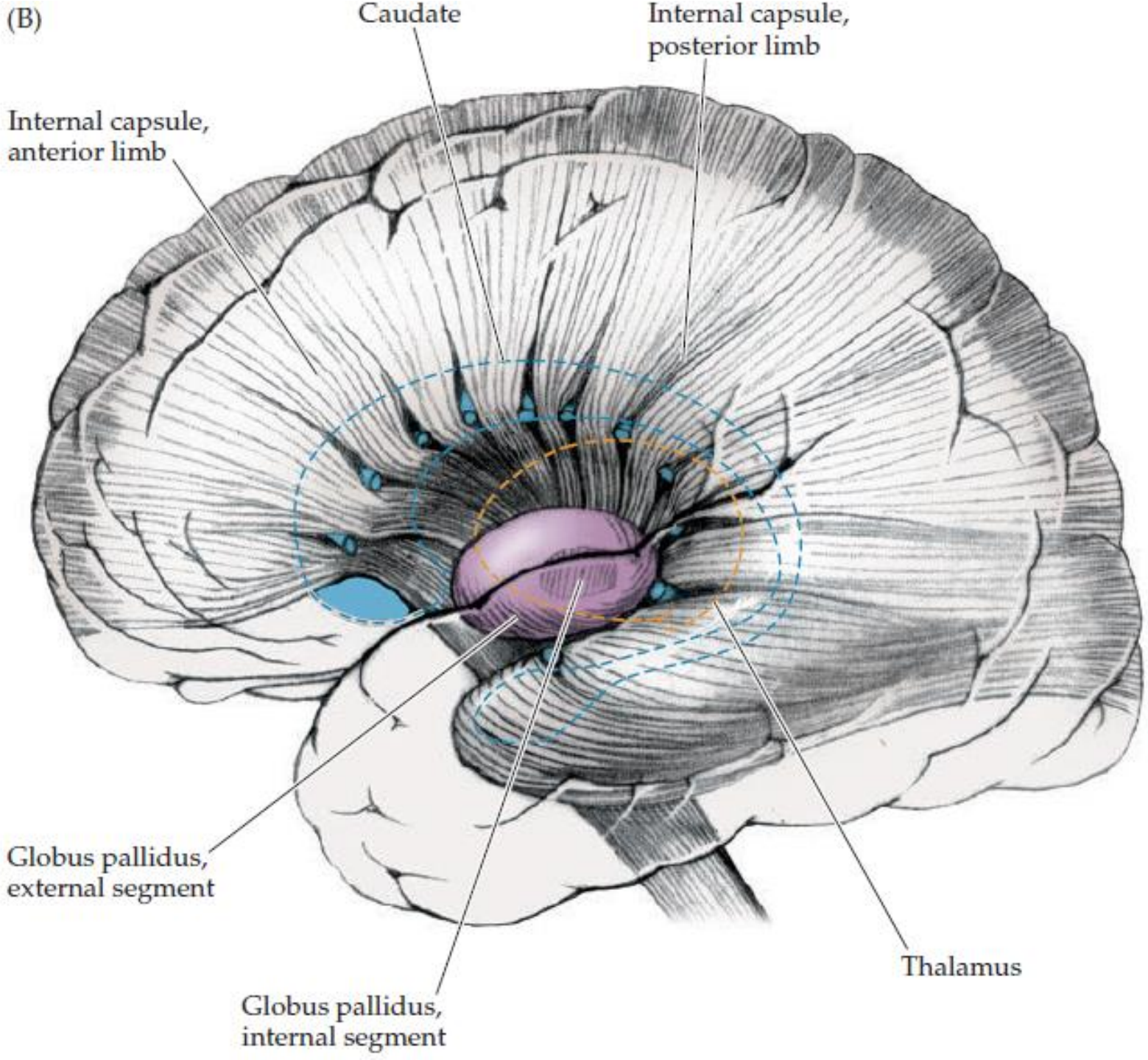
Nomenclatura

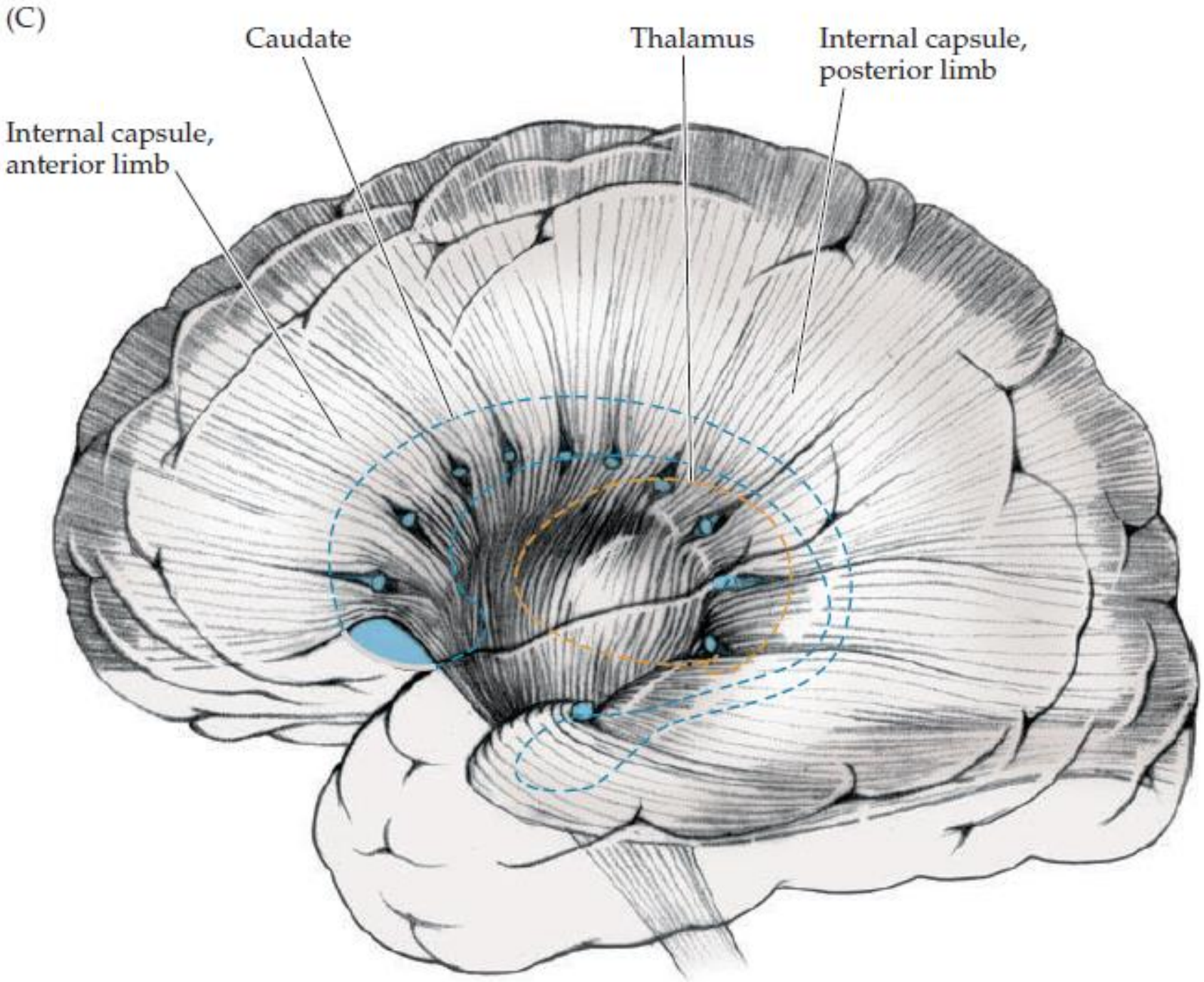
- Neo Estriado: Núcleo Caudado – Putamen.
- Paleoestriado: Globo Pálido (P. Externo – P. Interno).
- Estriado Dorsal: Núcleo Caudado – Putamen.
- Estriado Ventral: Núcleo Acumbens.
- Núcleo Lenticular: Putamen – Globo Pálido


(A)
Putamen
Body of caudate
Head of caudate
Cellular bridges
Lateral ventricle
Nucleus accumbens
Amygdala
Tail of caudate
(B)
Putamen
Body of caudate
Head of caudate
Thalamus
Nucleus accumbens
Globus pallidus, external segment
Globus pallidus, internal segment
Amygdala
Tail of caudate

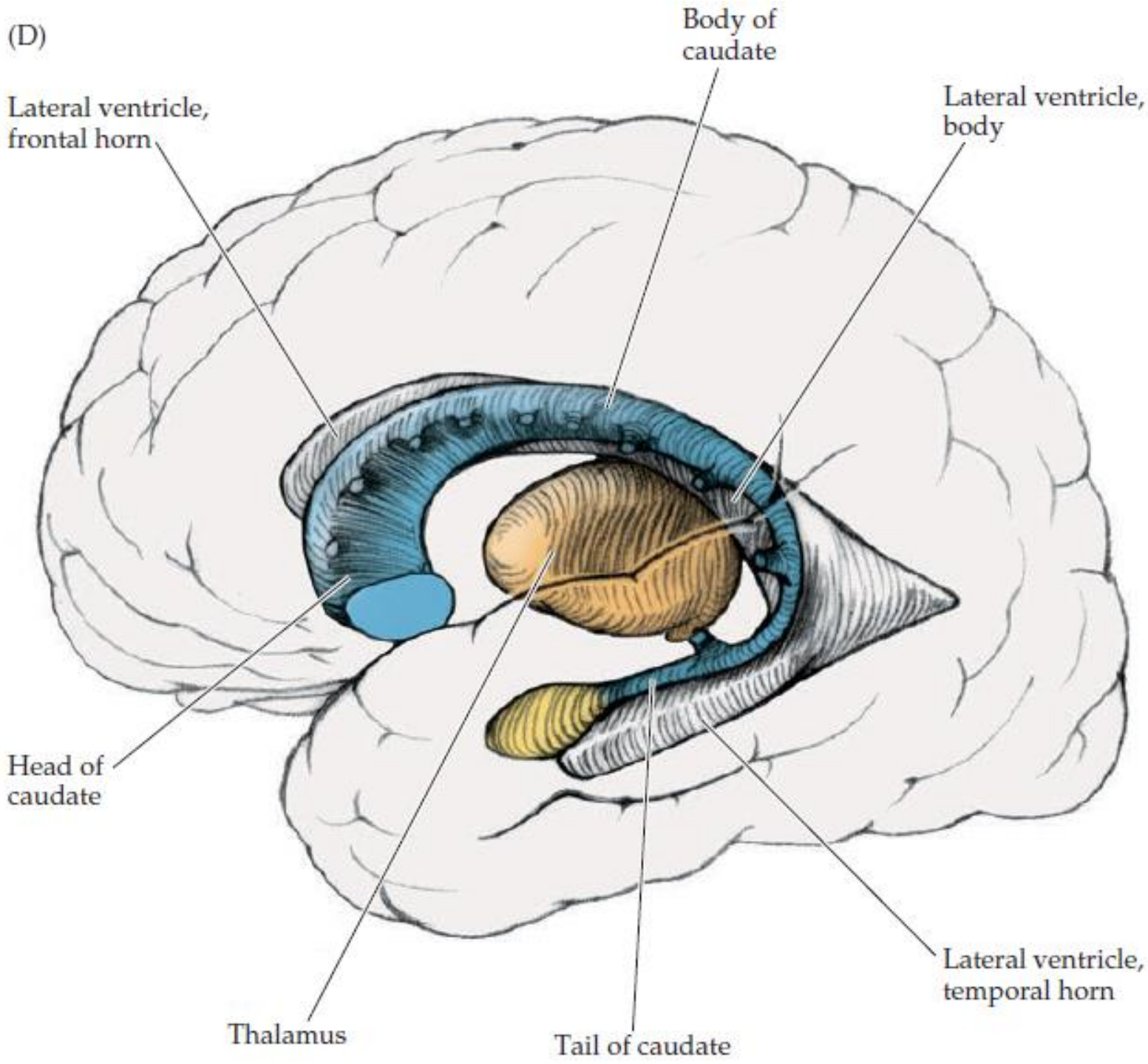
(A)

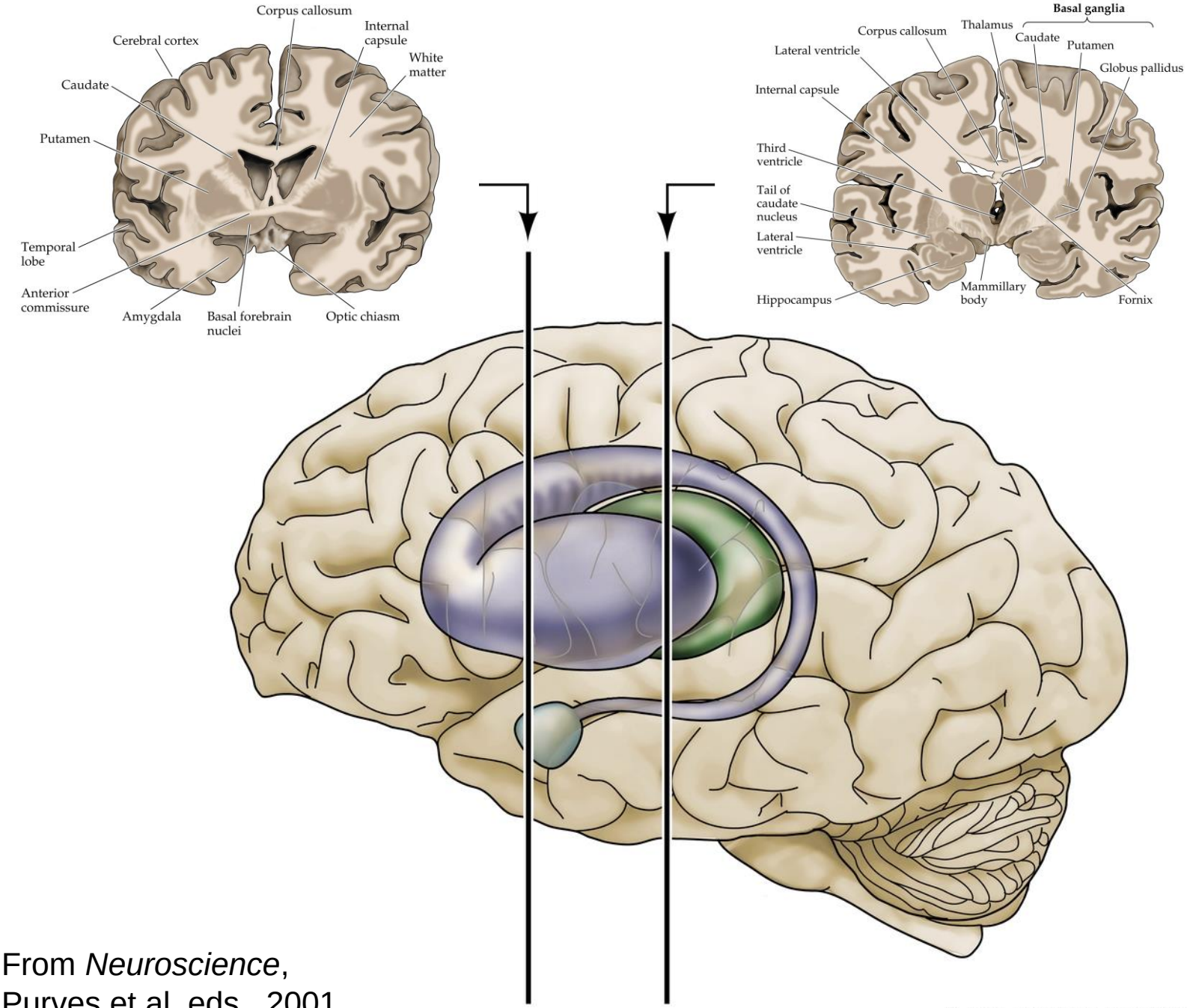

Caudate
Putamen
Internal capsule, posterior limb
Internal capsule, anterior limb
Globus pallidus
Tail of caudate in temporal lobe
Thalamus


(B)
Caudate
Internal capsule, posterior limb
Internal capsule, anterior limb
Globus pallidus, external segment
Globus pallidus, internal segment
Thalamus

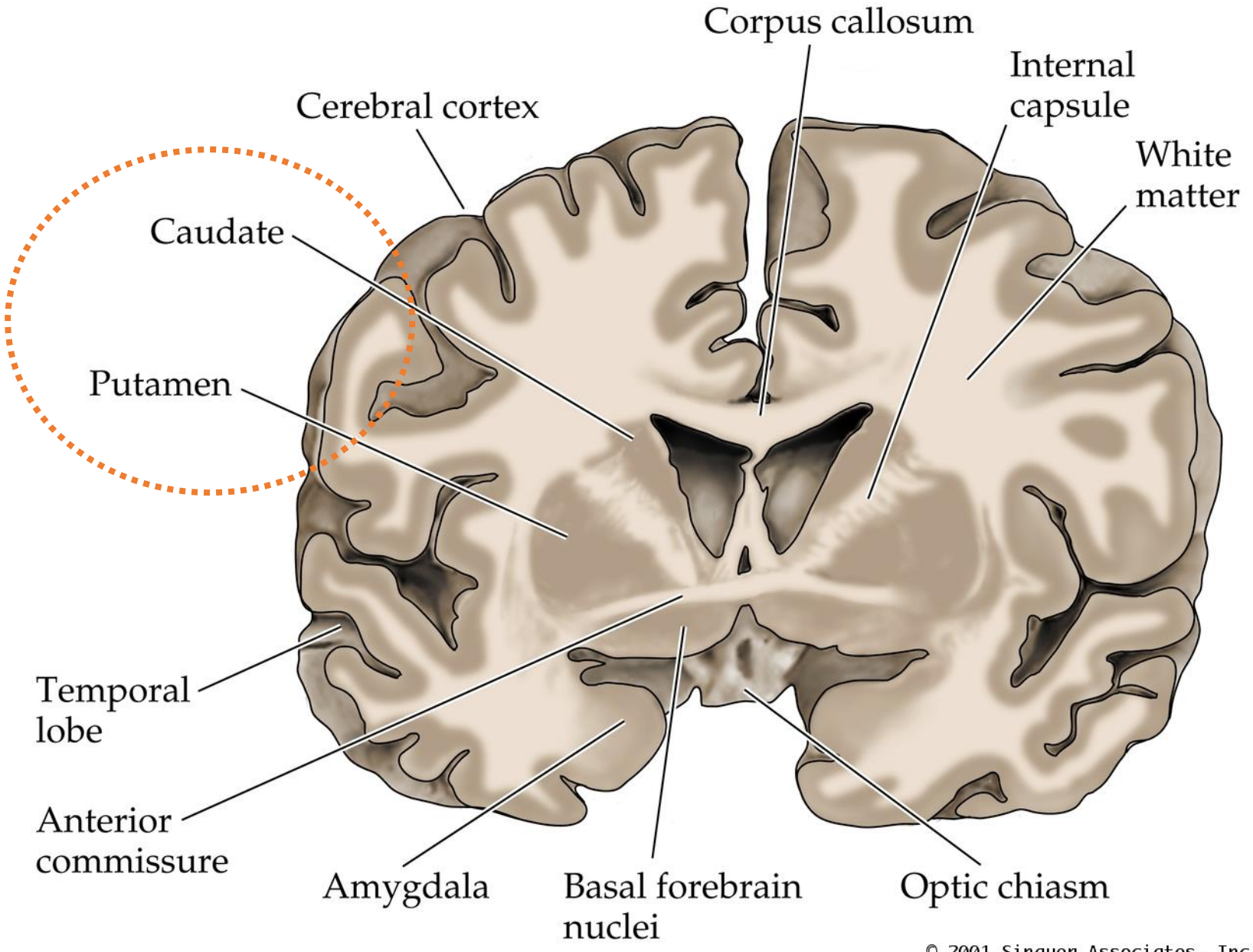

(C)
Caudate
Thalamus
Internal capsule, posterior limb
Internal capsule, anterior limb

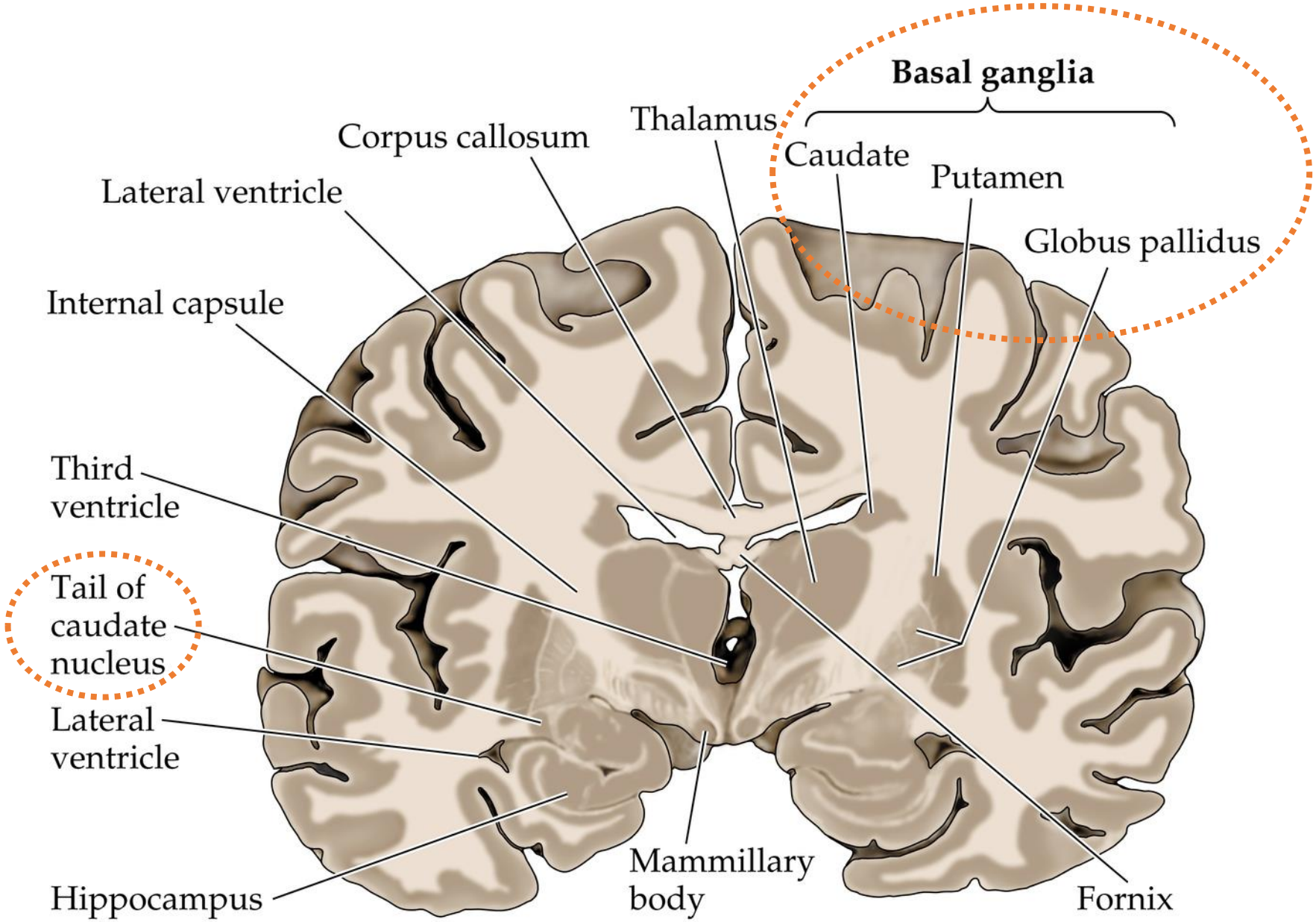
(D)


Body of caudate
Lateral ventricle, frontal horn
Lateral ventricle, body
Head of caudate
Thalamus
Tail of caudate
Lateral ventricle, temporal horn

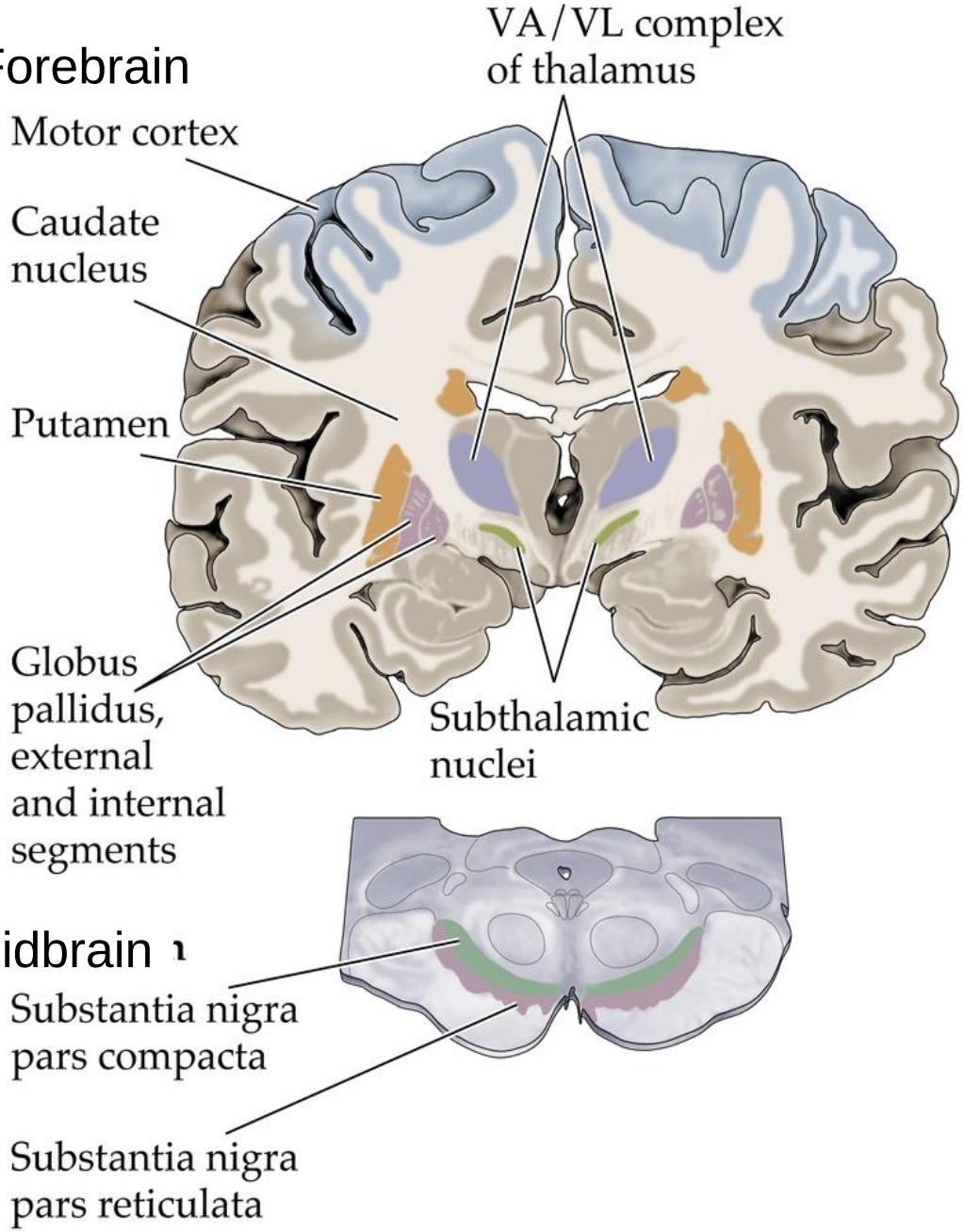


From *Neuroscience*,
Purves et al. eds., 2001

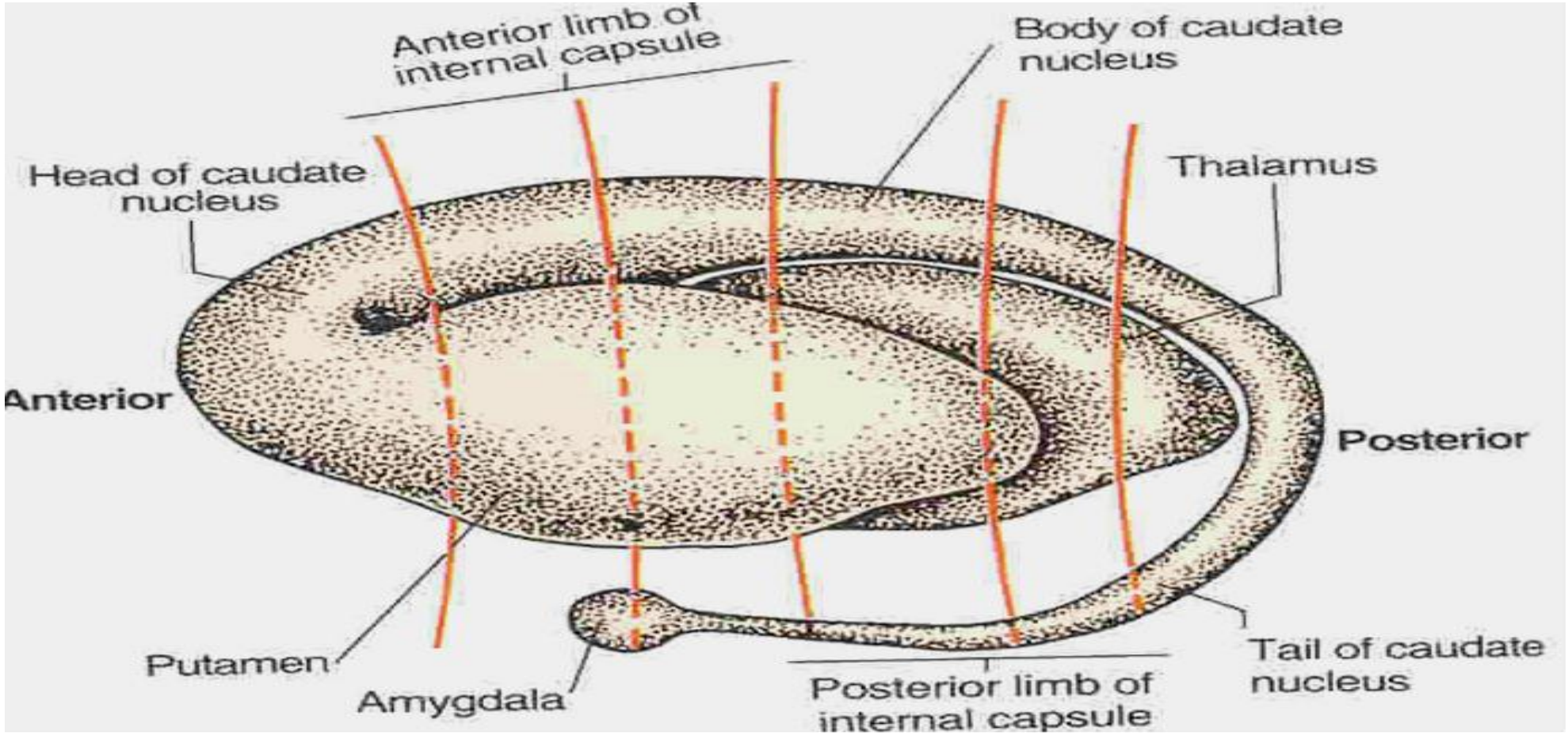




Forebrain

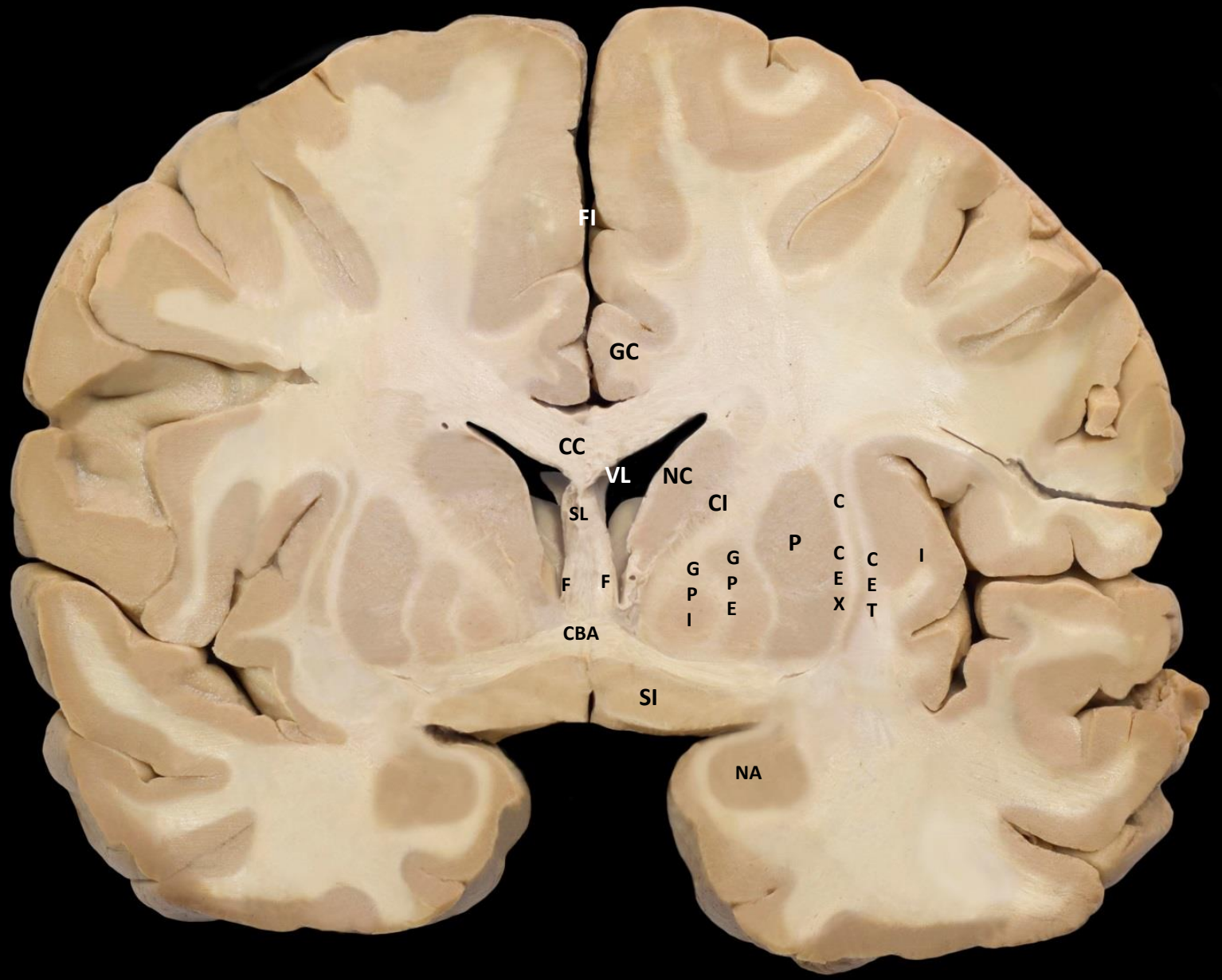


Núcleo Caudado

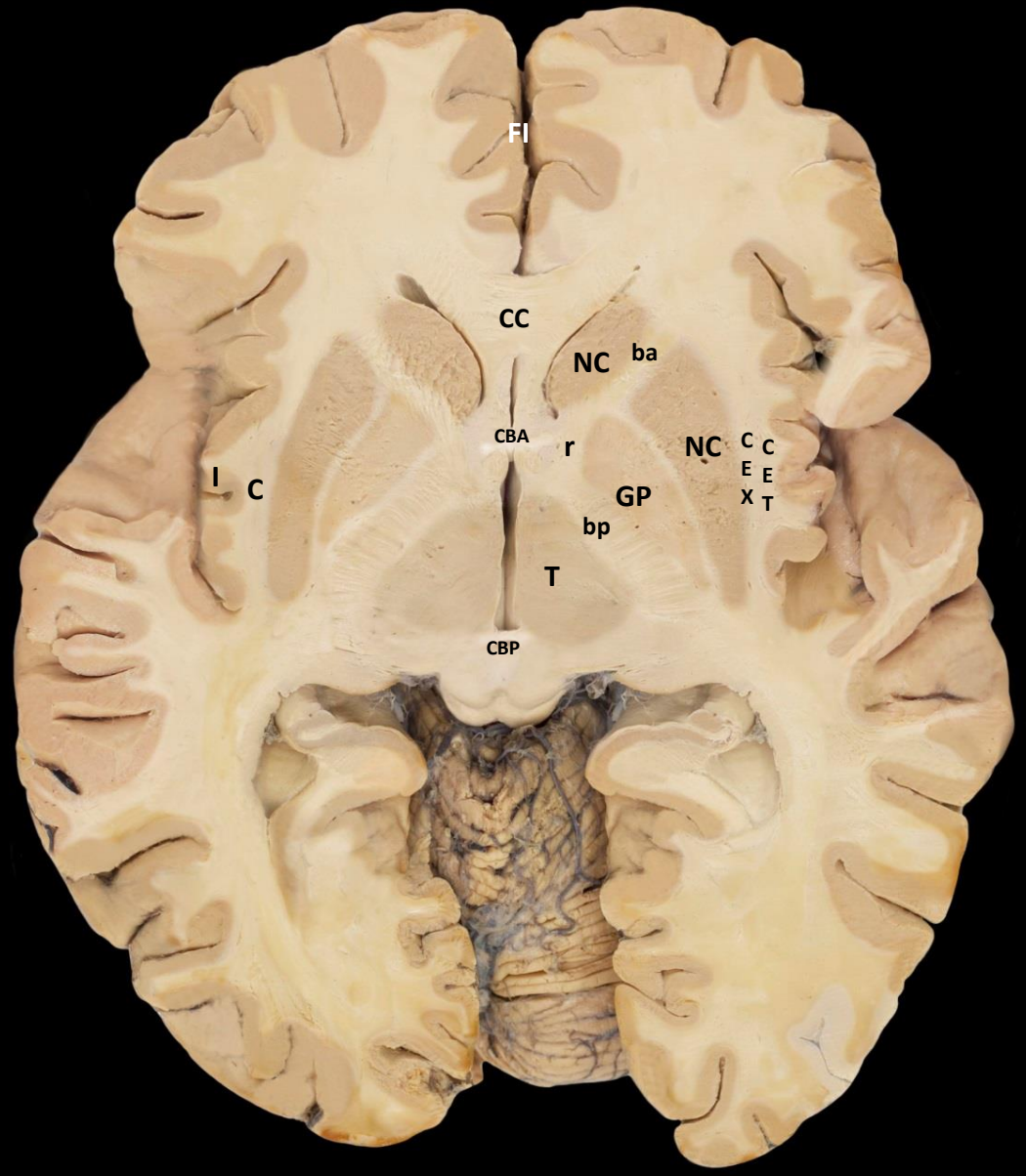


Núcleo Caudado

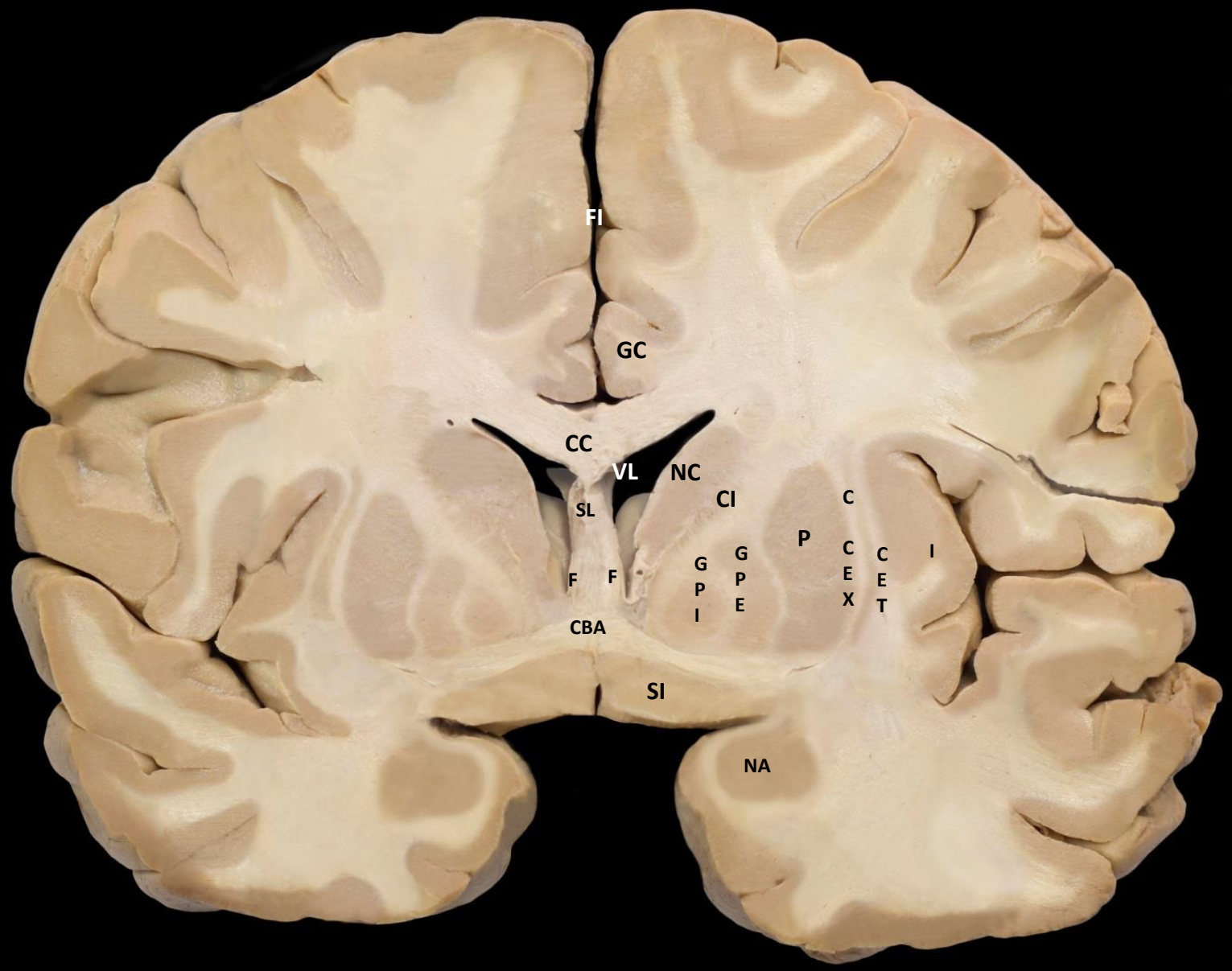
Putamen y Globo Pálido

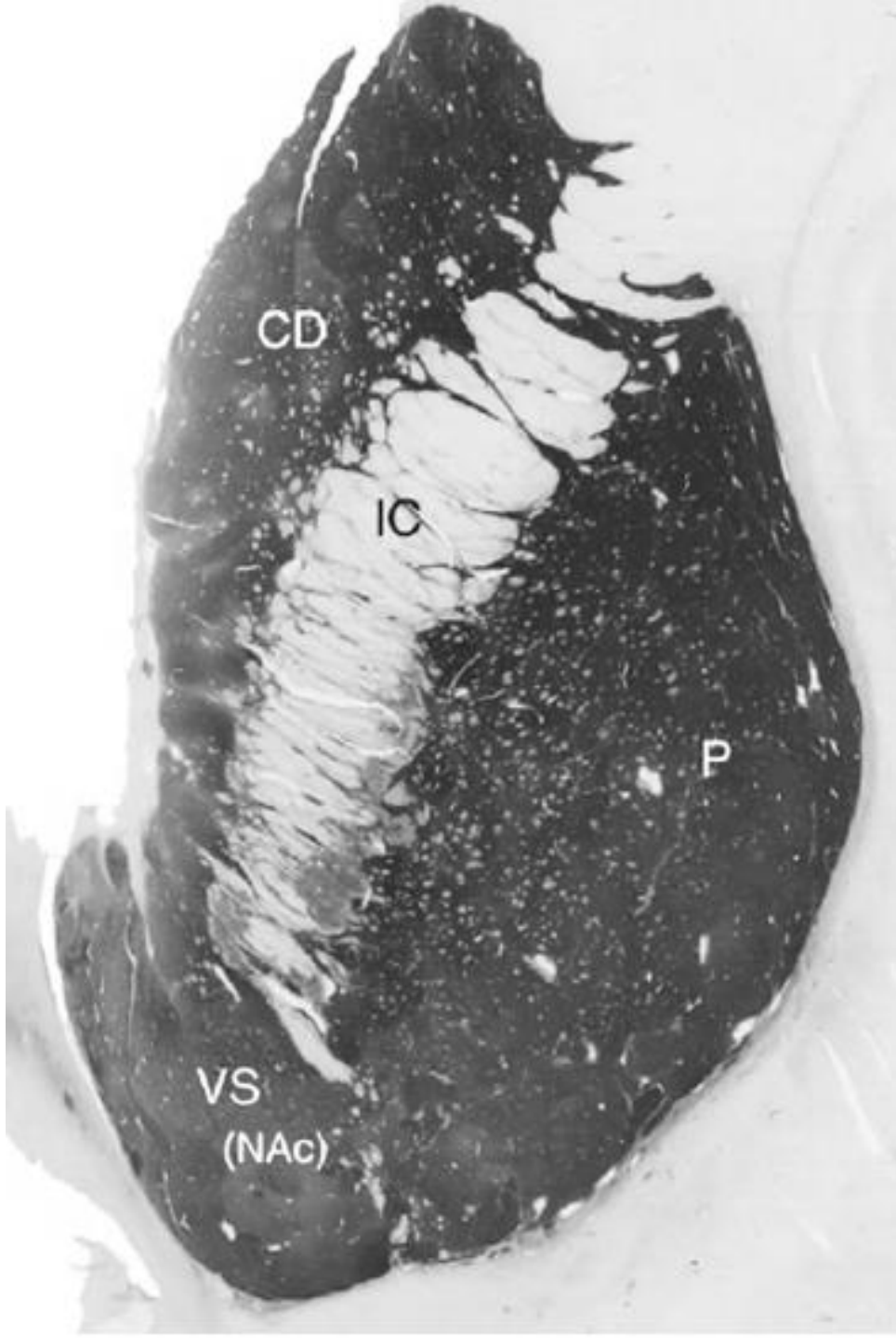


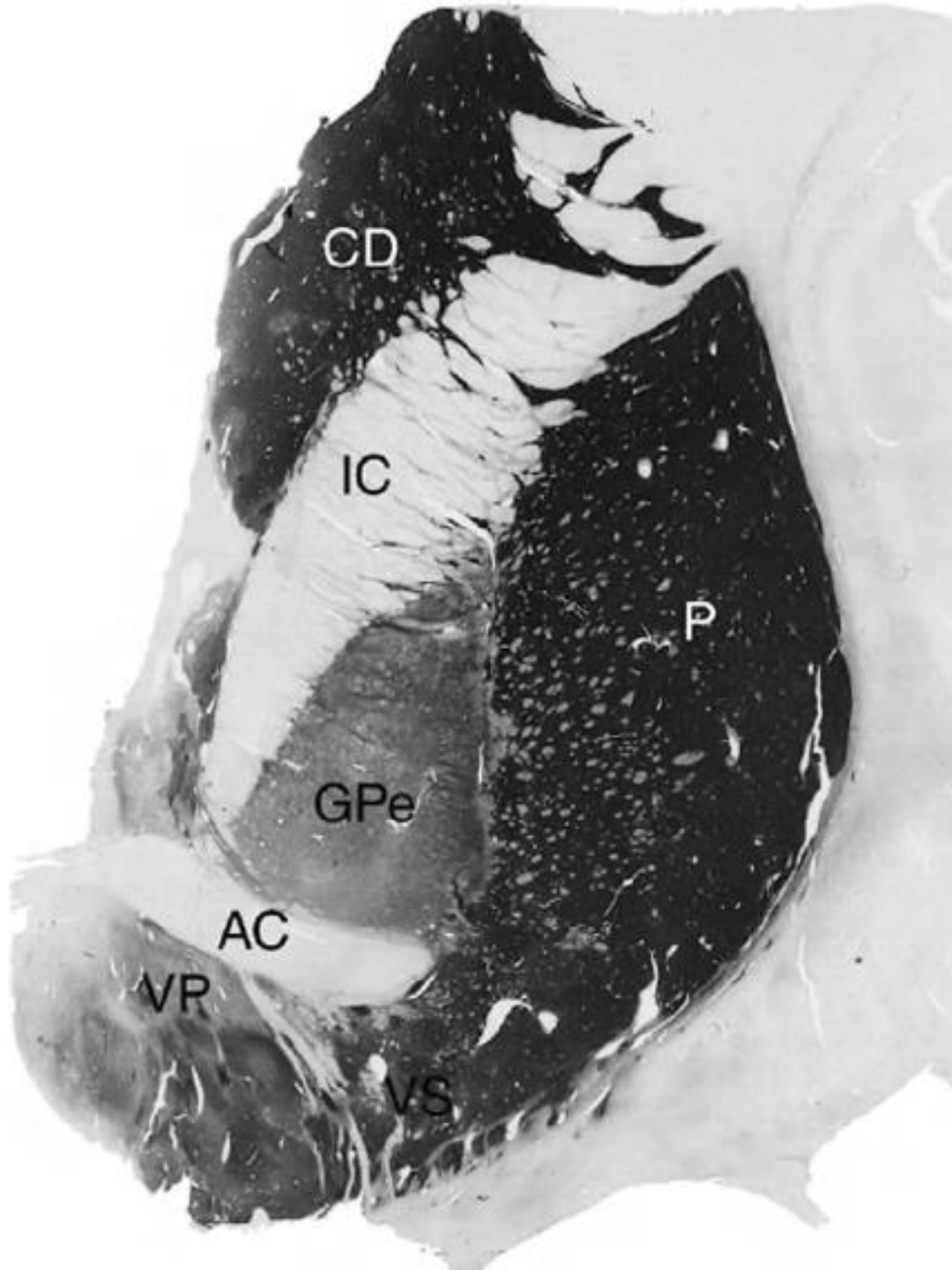
Putamen y Globo Pálido

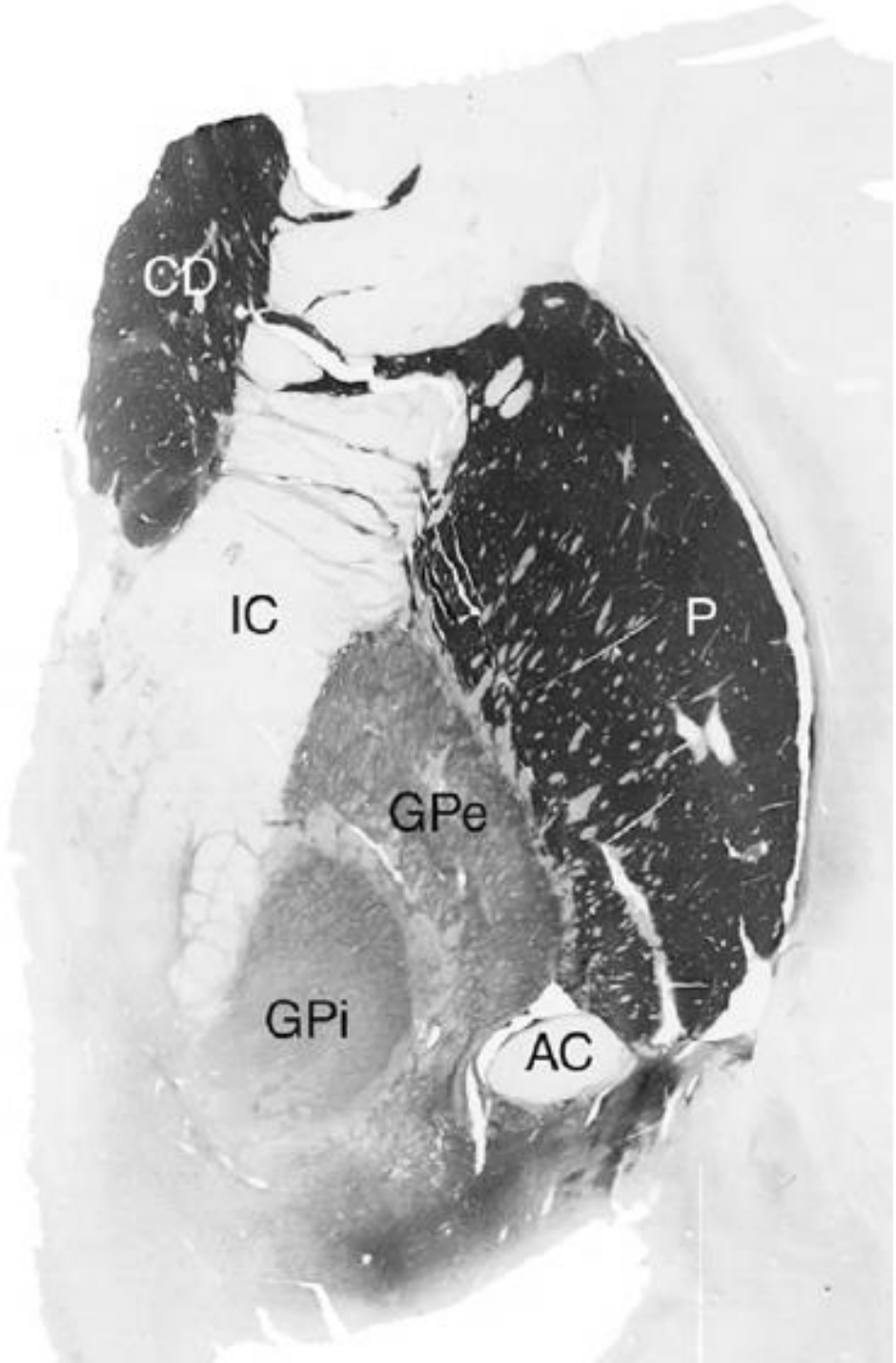


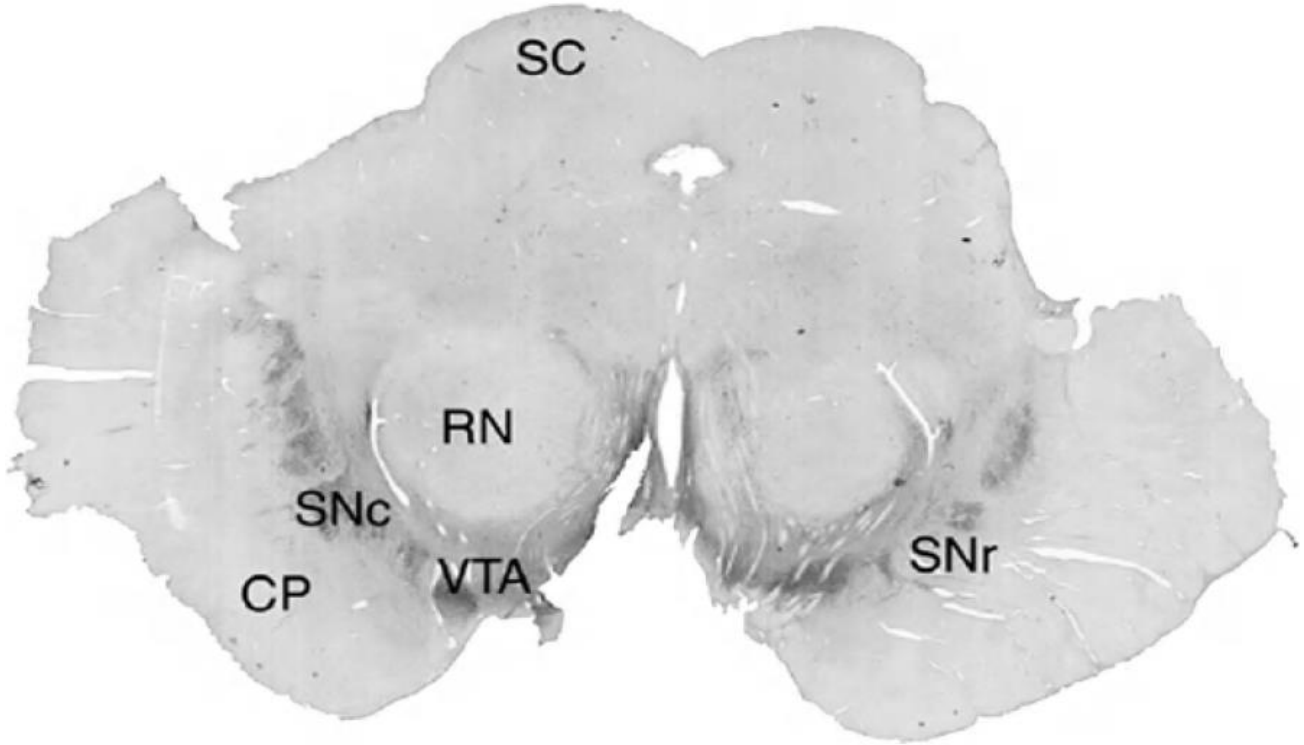
Putamen y Globo Pálido

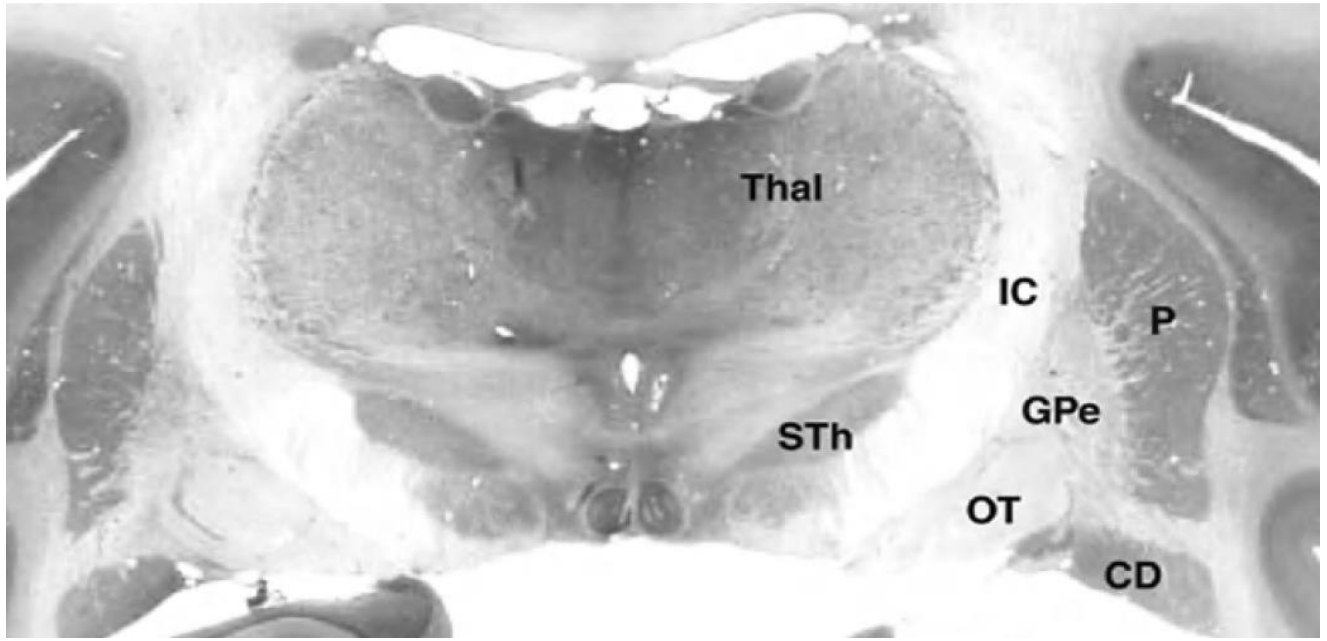


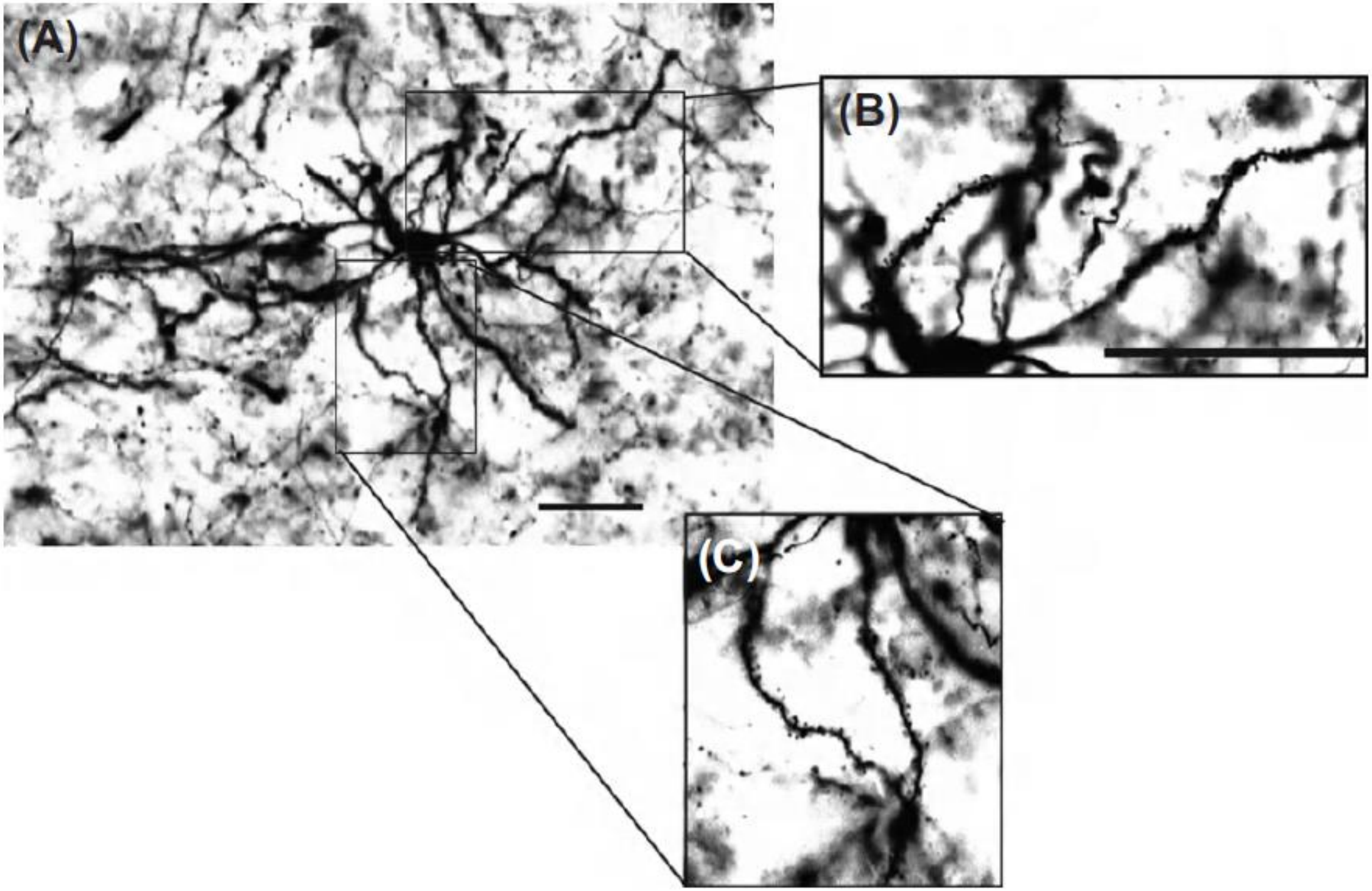

CD
IC
P
VS
(NAc)


CD
IC
P
GPe
AC
VP
VS

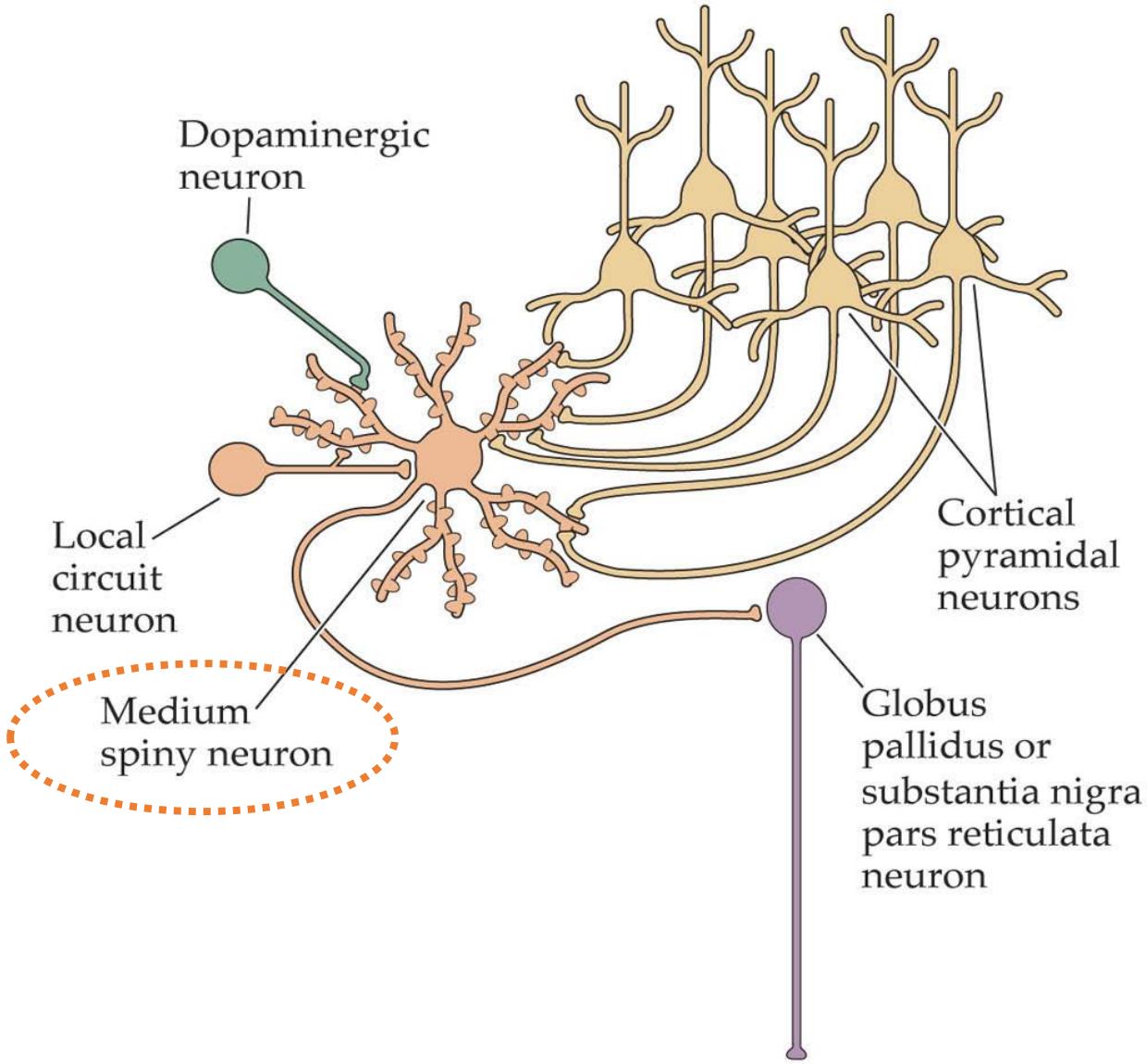

CD
IC
P
GPe
GPi
AC


SC
RN
SNc
CP
VTA
SNr

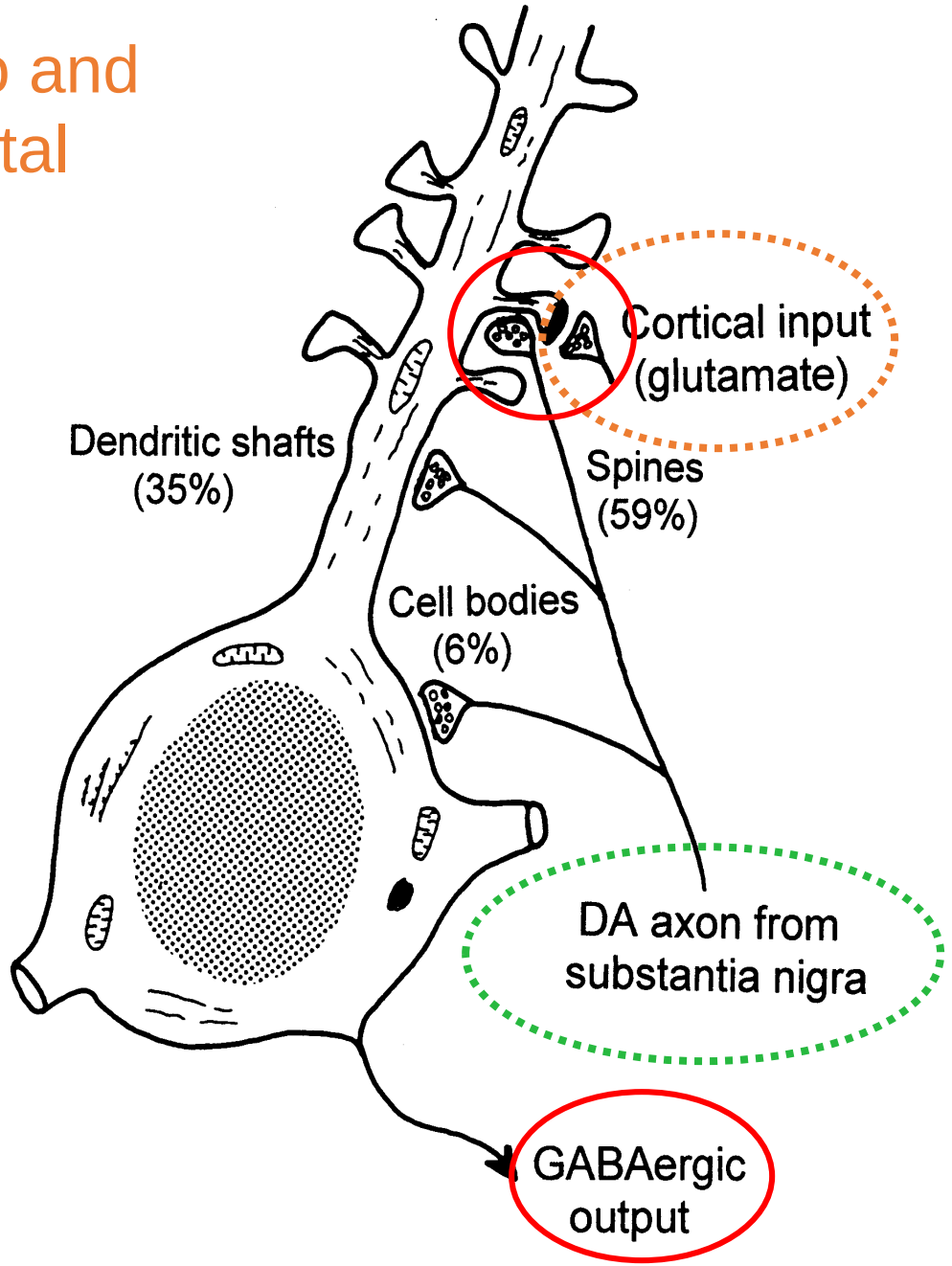

Thal
IC
P
GPe
STh
OT
CD


(A)
(B)
(C)

Neurons of the basal ganglia



Synaptic input to and output from striatal medium spiny neurons

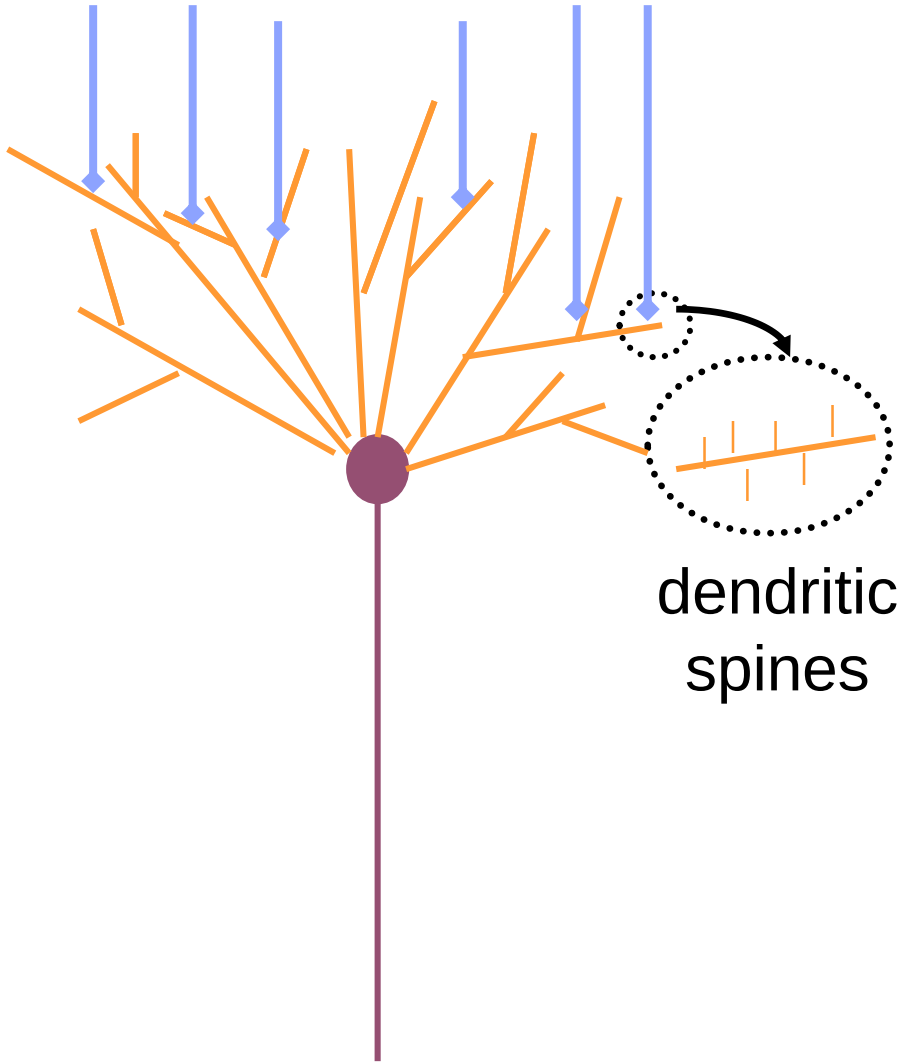


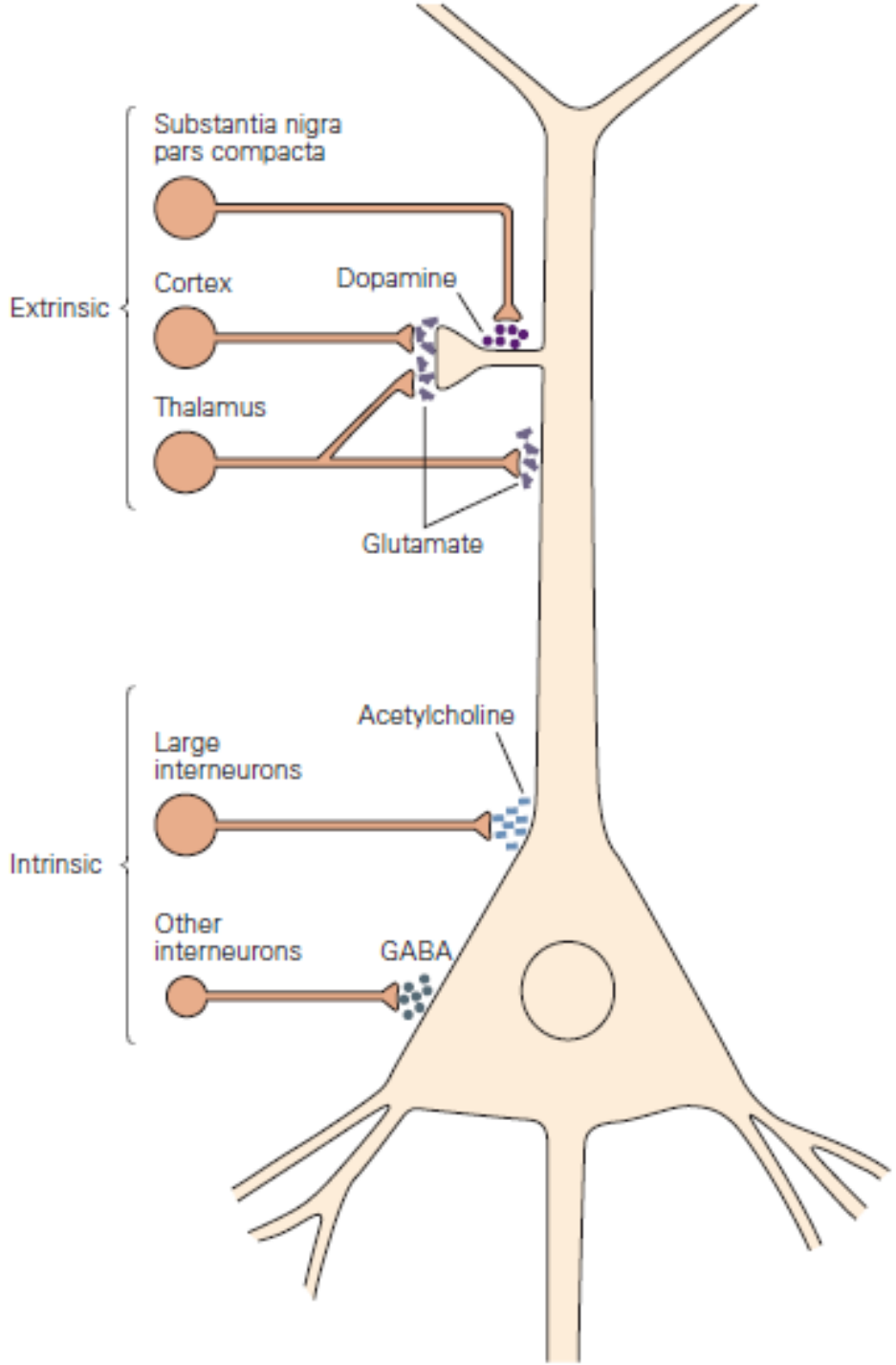
Smith and Bolam 1990

Basal ganglia loops

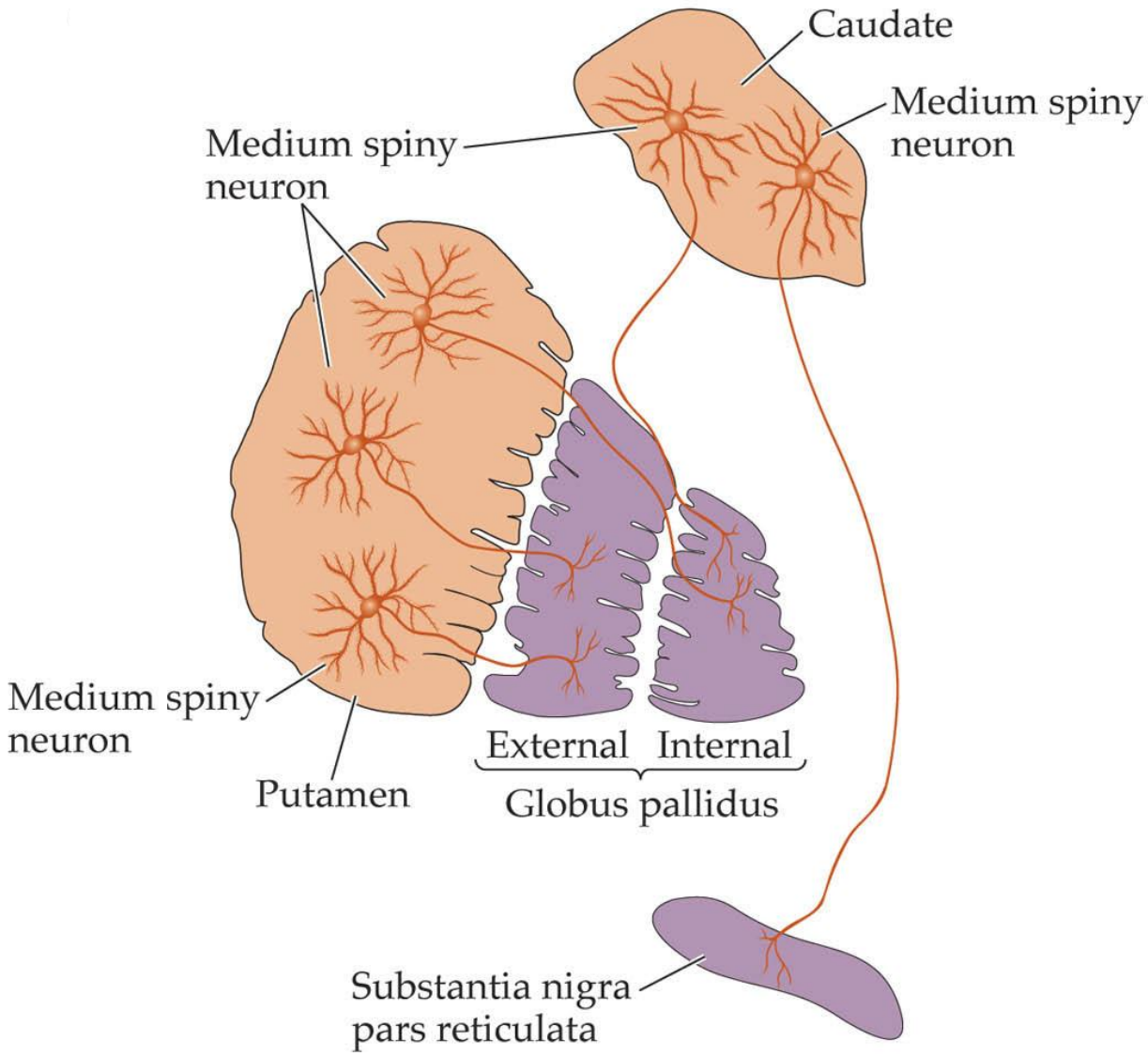
Convergence

- large dendritic trees of striatal output neurons (medium spiny neurons)

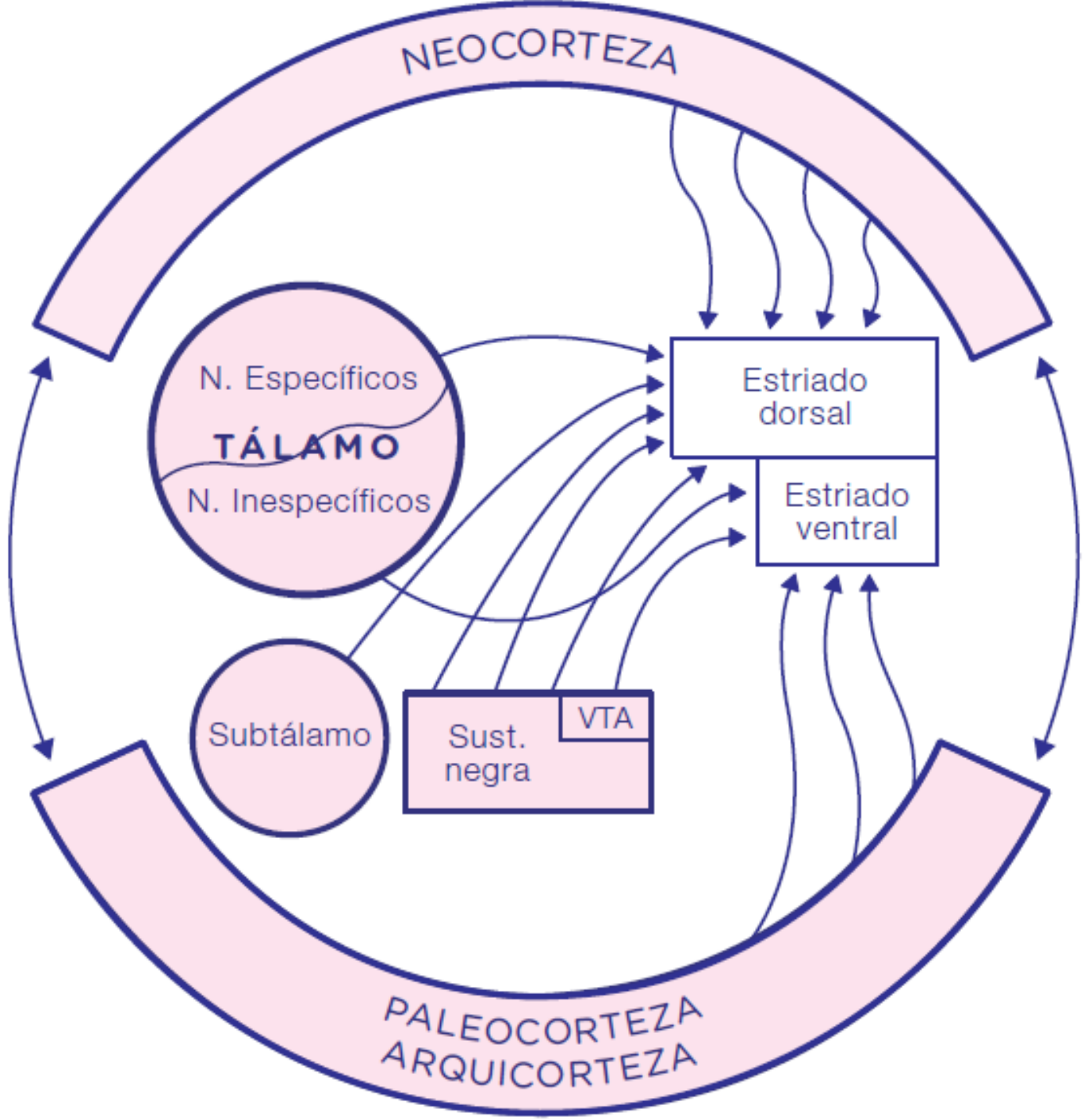



Substantia nigra
pars compacta
Extrinsic
Cortex
Dopamine
Thalamus
Glutamate
Acetylcholine
Large
interneurons
Intrinsic
Other
interneurons
GABA

Medium spiny neuron projections

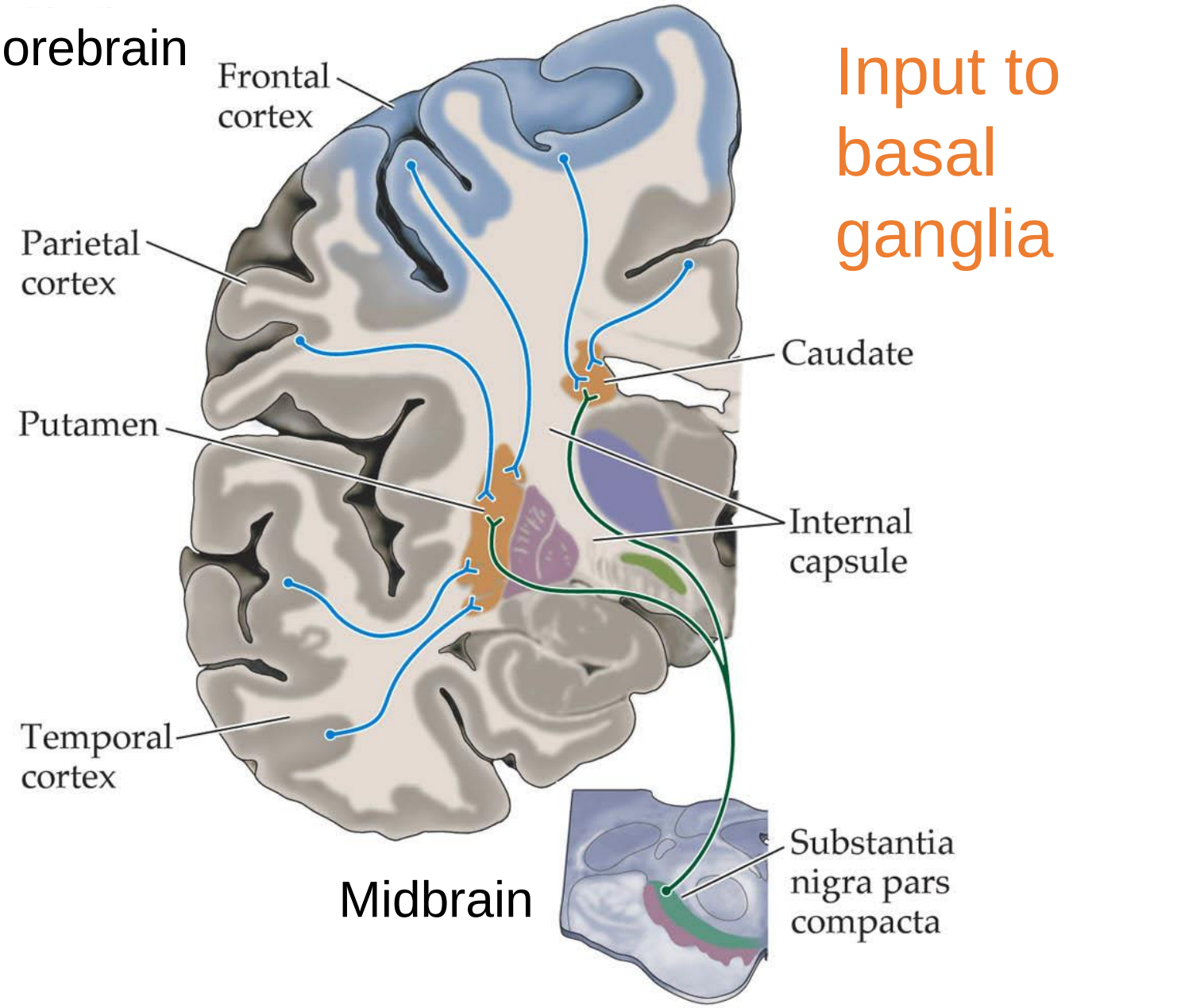


NEUROSCIENCE, Third Edition, **Figure 17.3 (Part 1)**


NEOCORTEZA
N. Específicos
TÁLAMO
N. Inespecíficos
Estriado dorsal
Estriado ventral
Subtálamo
Sust. negra
VTA
PALEOCORTEZA
ARQUICORTEZA

Forebrain

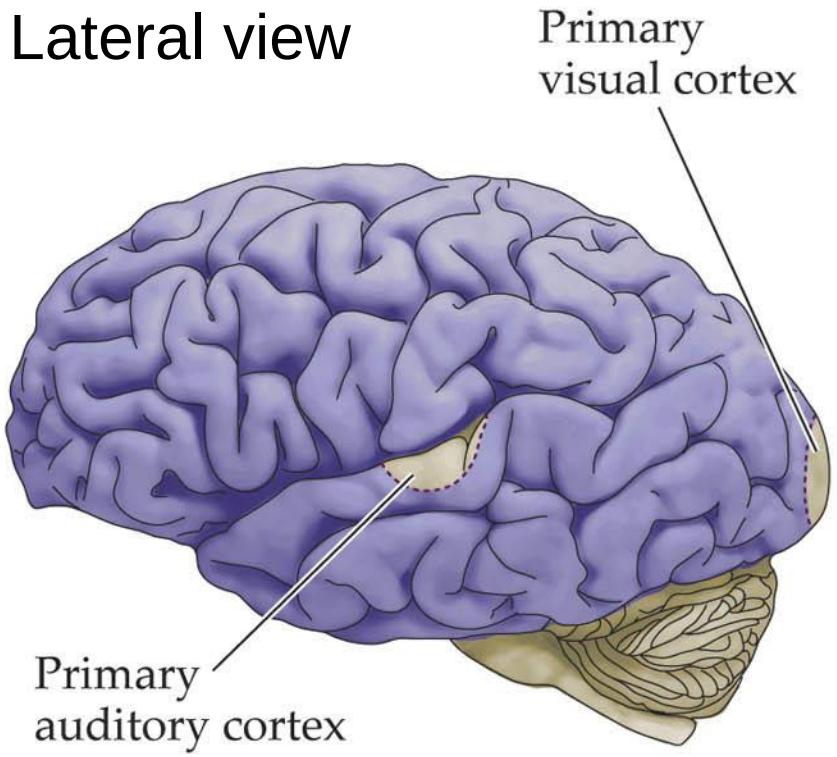
Input to basal ganglia



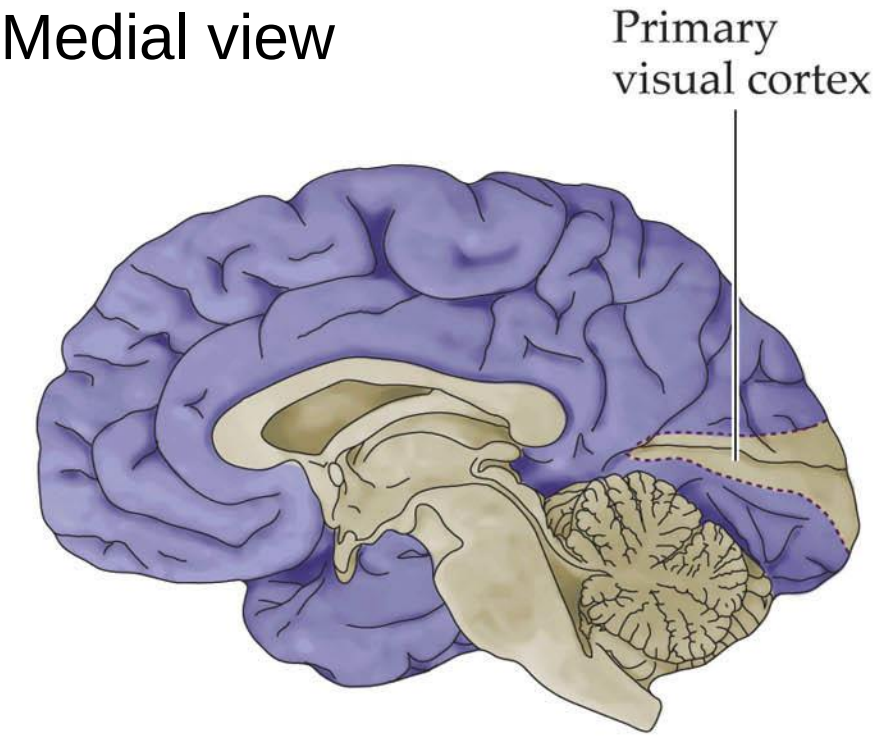
Midbrain

Regions of cortical input to the basal ganglia (blue)

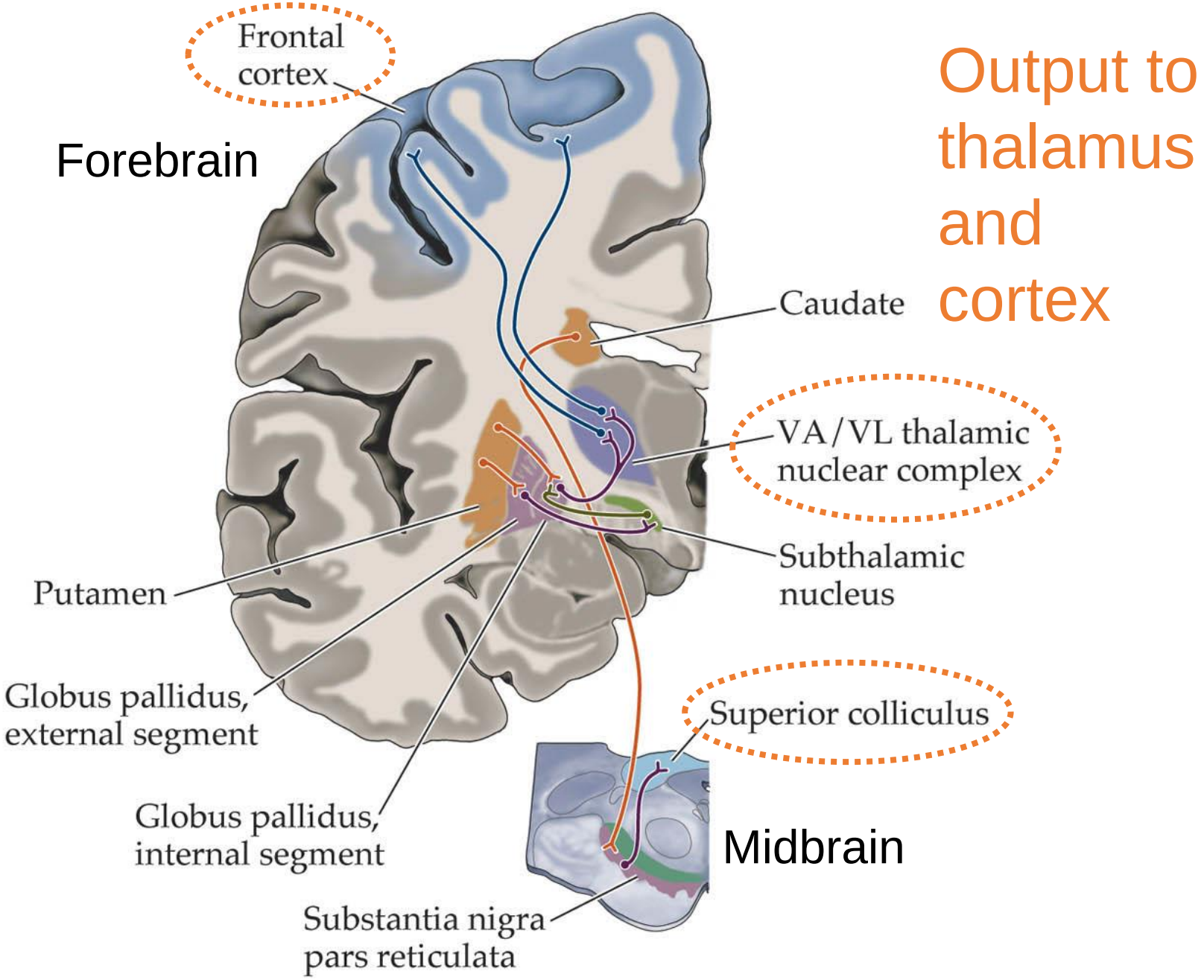
Lateral view



Medial view

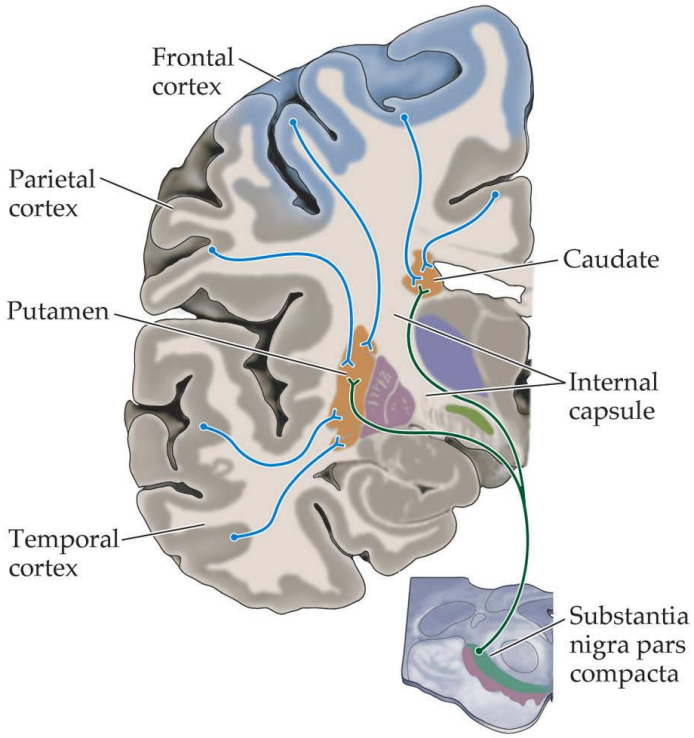


Output to thalamus and cortex

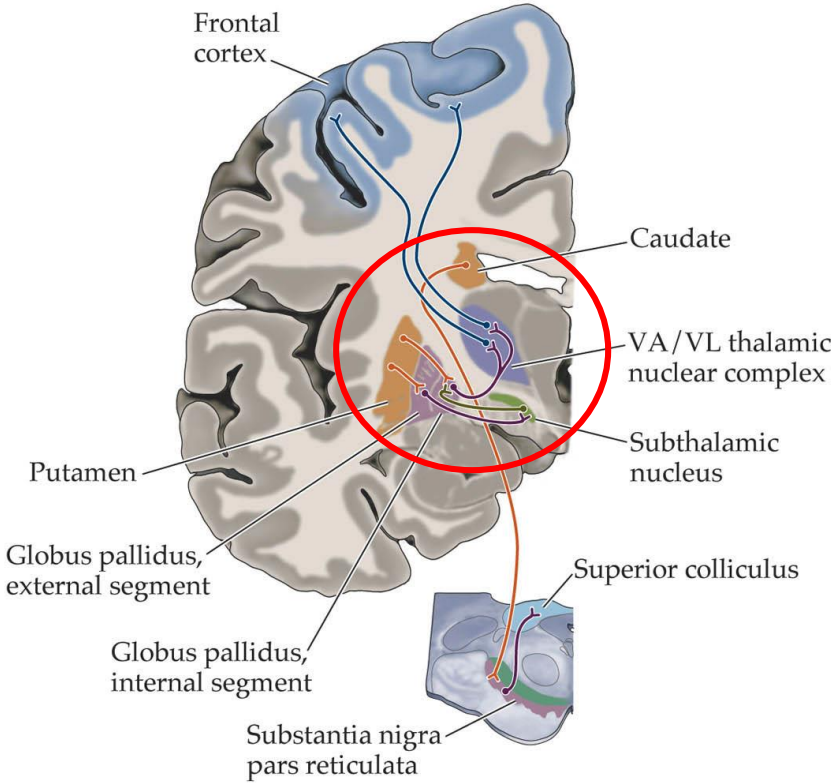


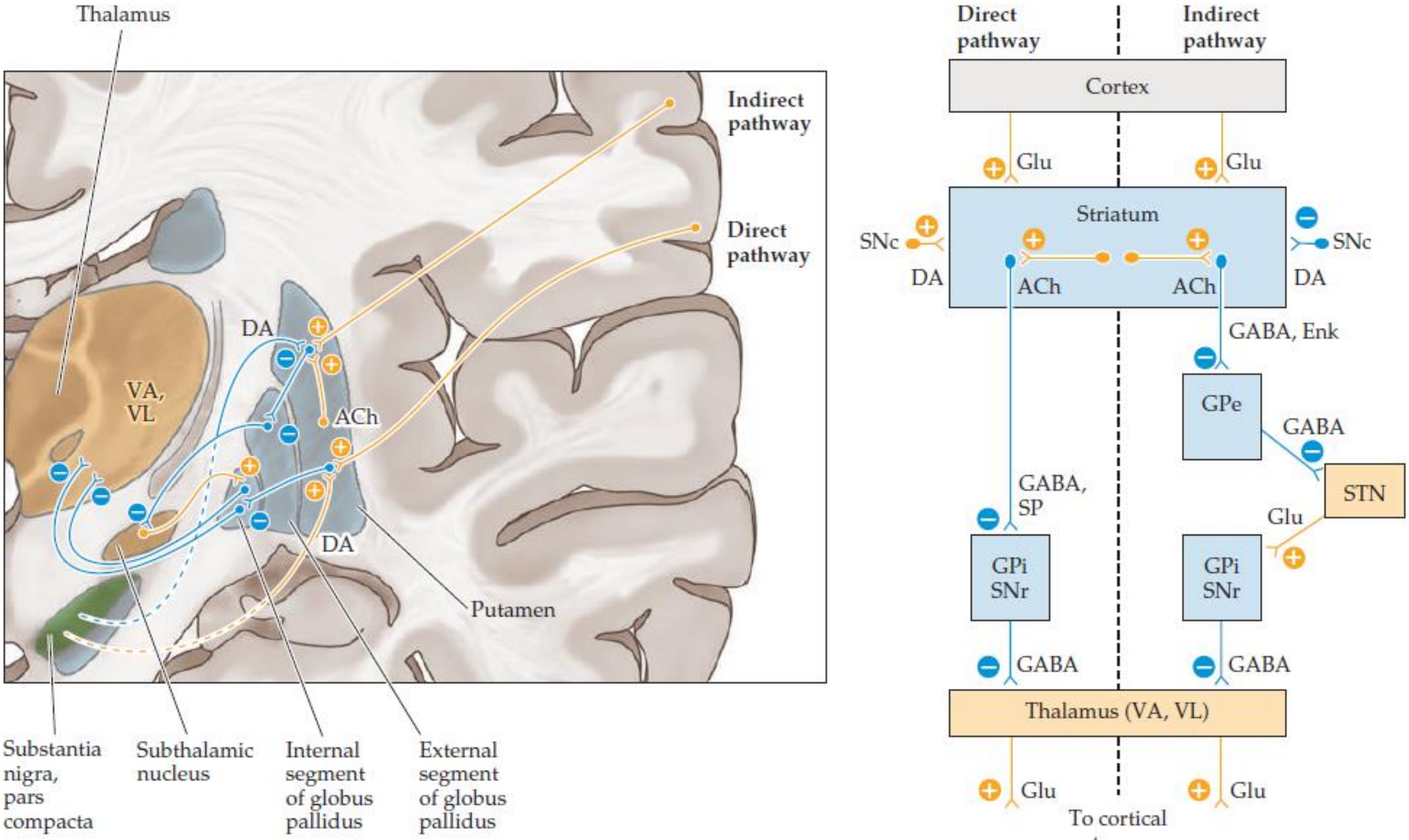
NEUROSCIENCE, Third Edition, Figure 17.5 (Part 2) © 2004 Sinauer Associates, Inc.

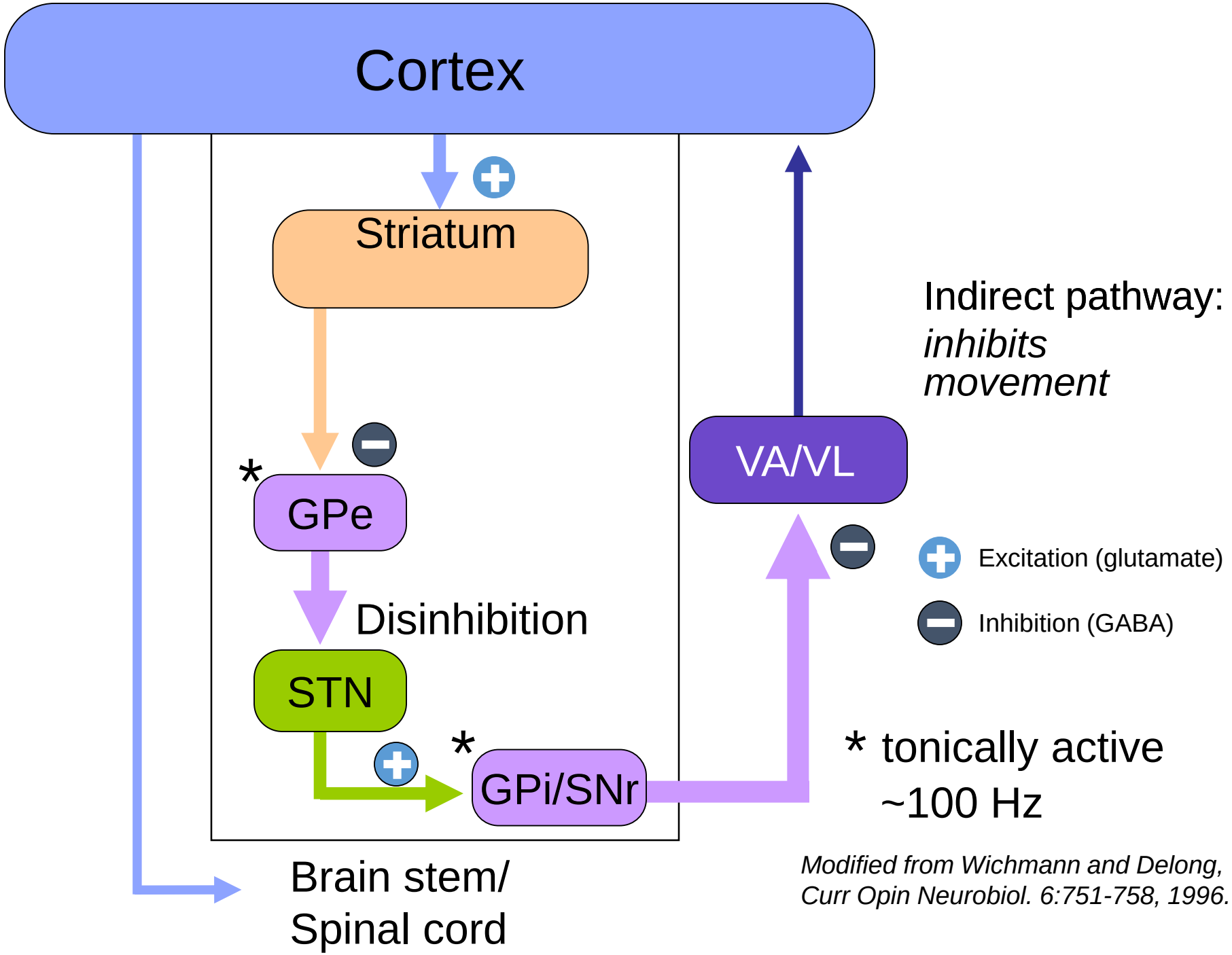
Input



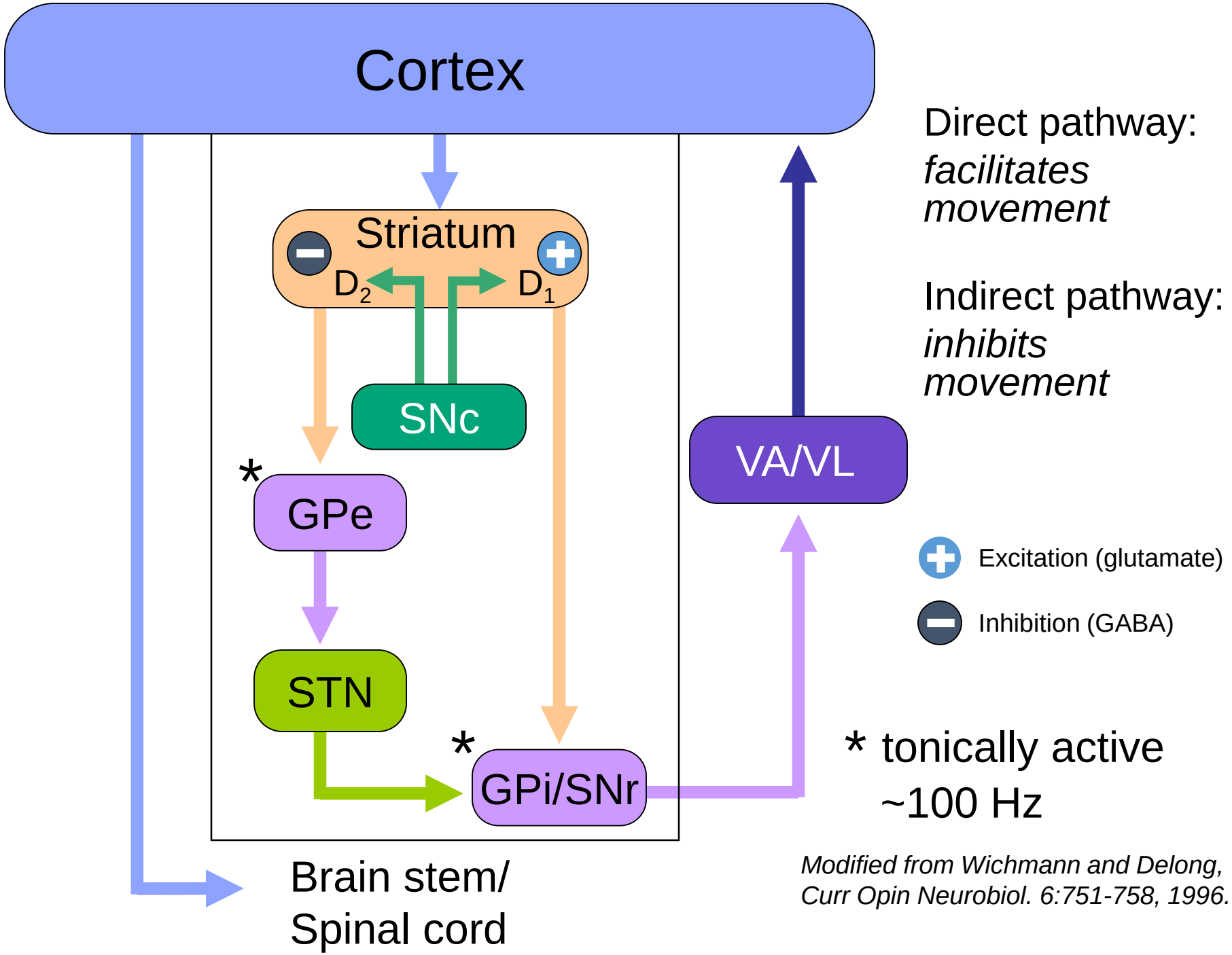
Output and internal circuitry

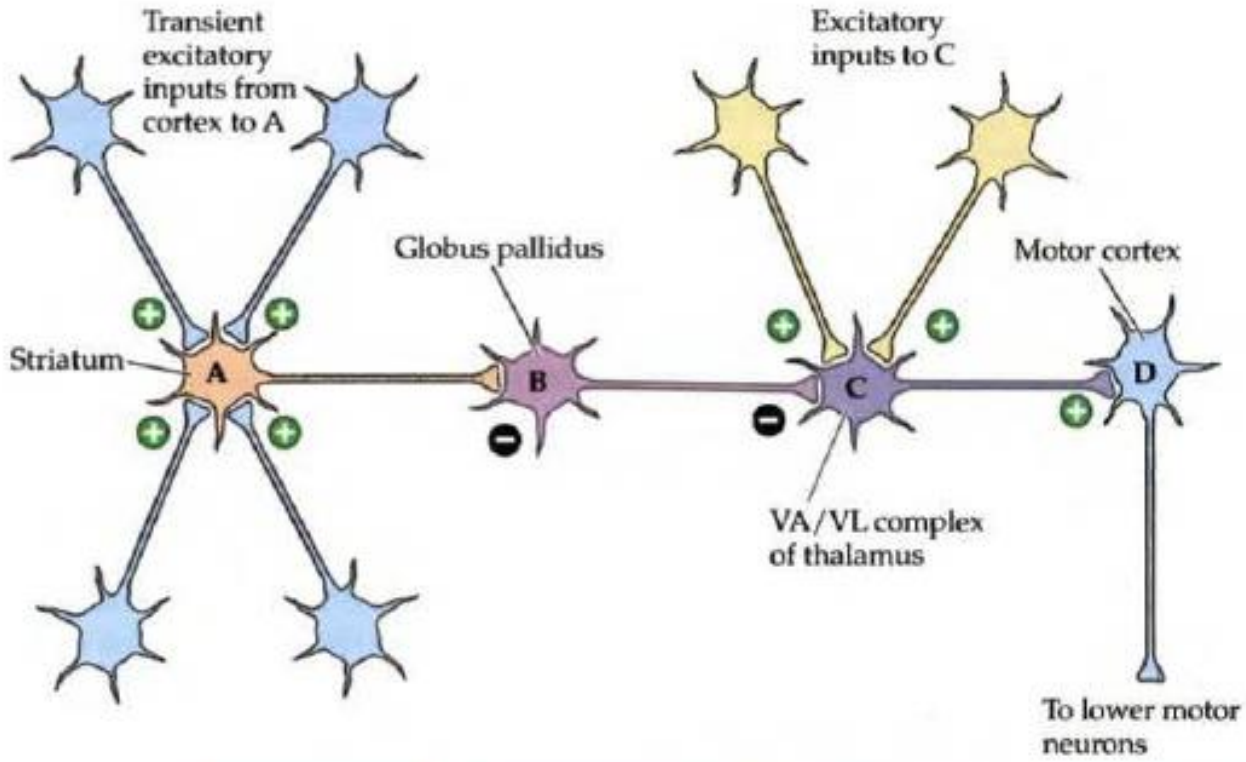


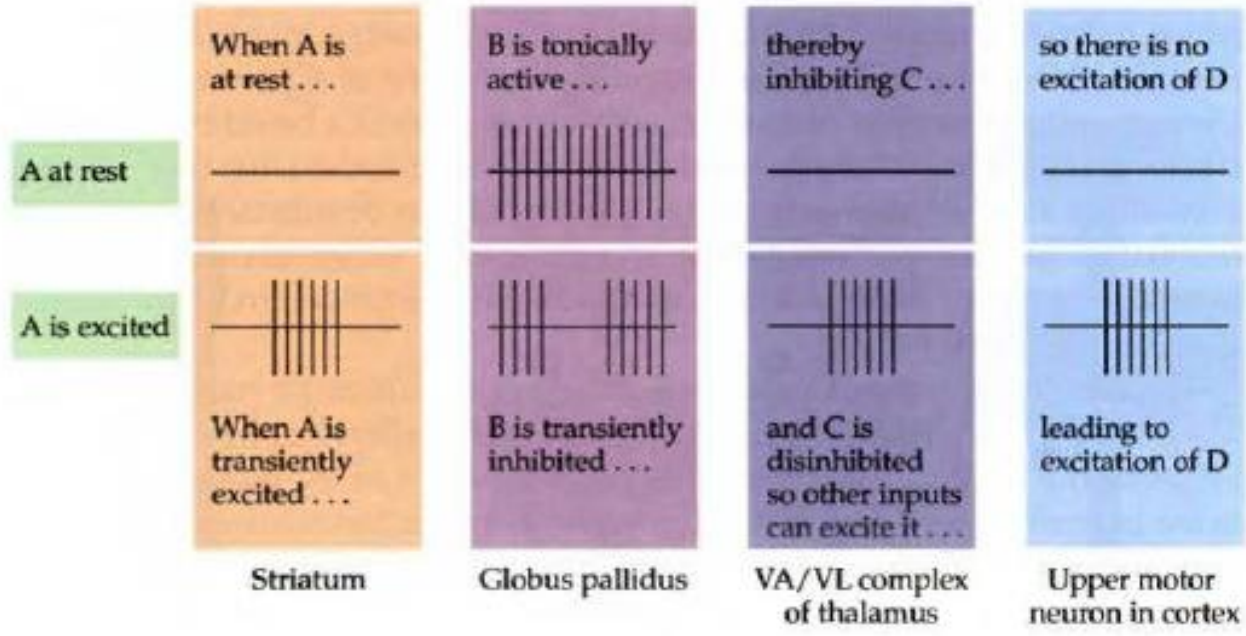

Thalamus
Indirect pathway
Direct pathway
DA
VA, VL
ACh
DA
Putamen
Substantia nigra, pars compacta
Subthalamic nucleus
Internal segment of globus pallidus
External segment of globus pallidus
Direct pathway
Indirect pathway
Cortex
Glu
Glu
Striatum
SNc
DA
ACh
ACh
SNc
DA
GABA, Enk
GPe
GABA
STN
Glu
GABA, SP
GPi SNr
GPi SNr
GABA
GABA
Thalamus (VA, VL)
Glu
Glu
To cortical

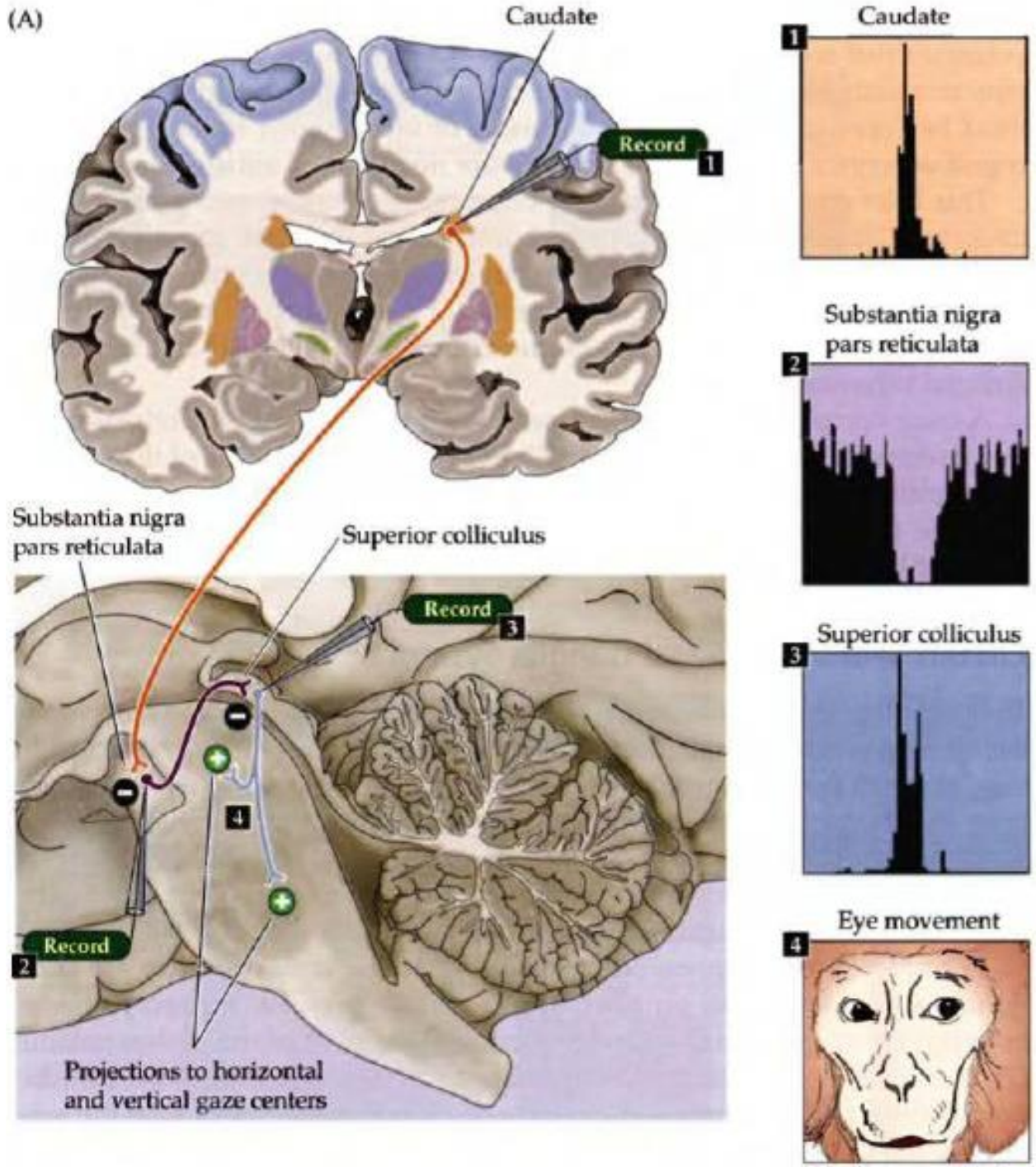


Modified from Wichmann and Delong, Curr Opin Neurobiol. 6:751-758, 1996.


Cortex
Striatum
D2
D1
SNc
*
GPe
STN
*
GPi/SNr
VA/VL
Brain stem/
Spinal cord
Direct pathway:
facilitates
movement
Indirect pathway:
inhibits
movement
Excitation (glutamate)
Inhibition (GABA)
* tonically active
~100 Hz
Modified from Wichmann and Delong,
Curr Opin Neurobiol. 6:751-758, 1996.

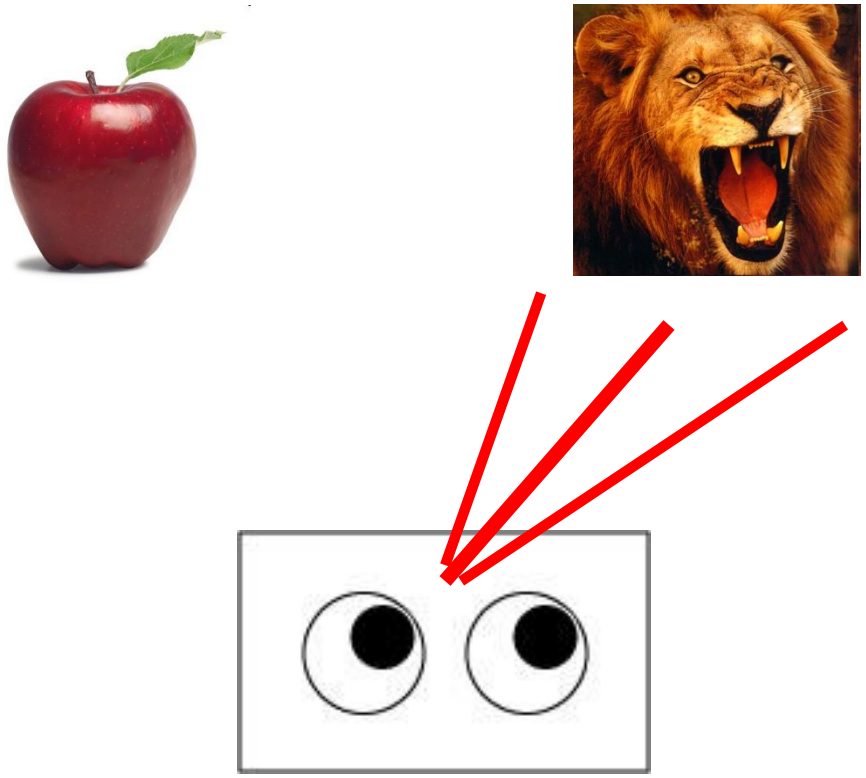

Transient excitatory inputs from cortex to A
Excitatory inputs to C
Globus pallidus
Motor cortex
Striatum
A
B
C
D
VA/VL complex of thalamus
To lower motor neurons

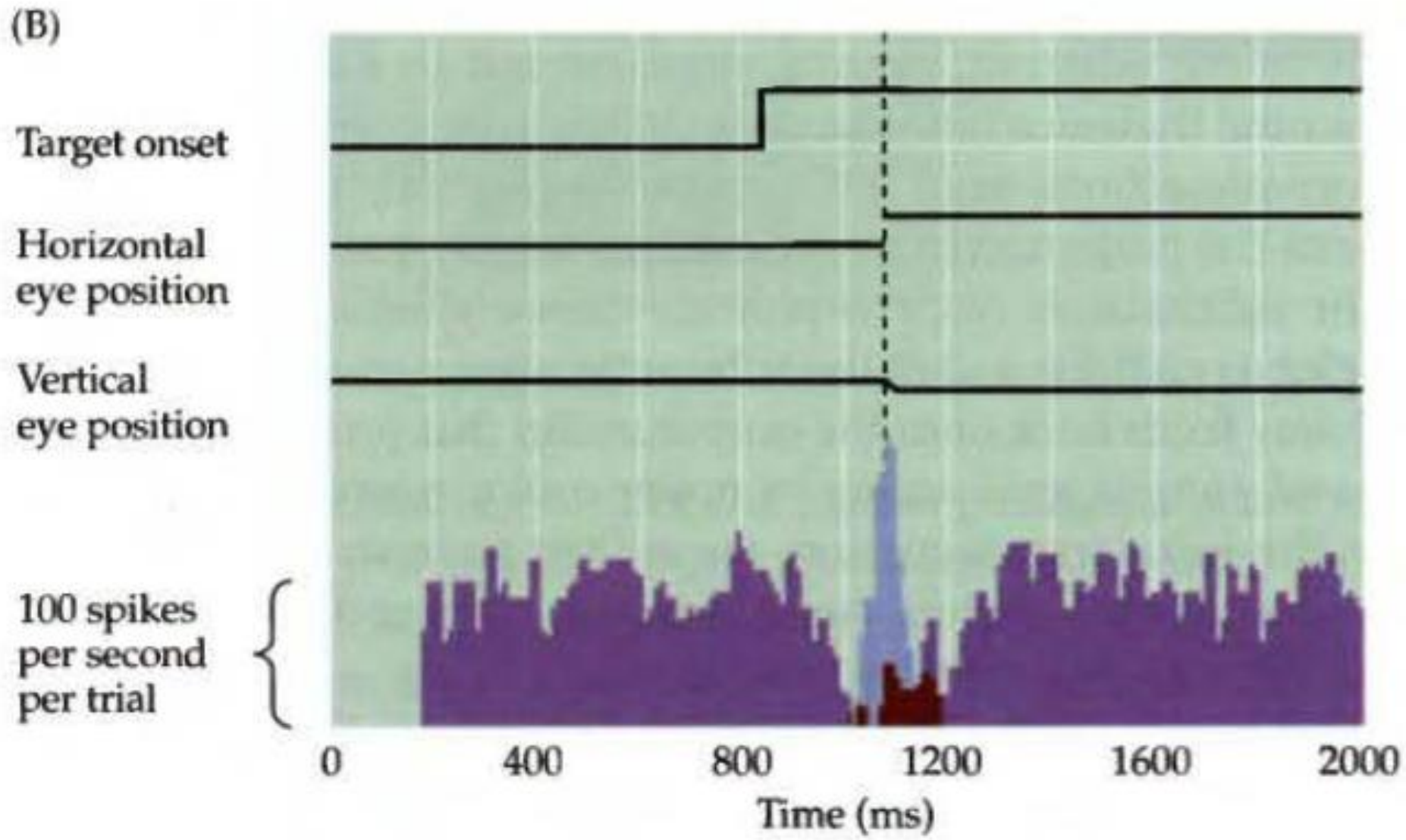

When A is at rest . . .
B is tonically active . . .
thereby inhibiting C . . .
so there is no excitation of D
A at rest
A is excited
When A is transiently excited . . .
B is transiently inhibited . . .
and C is disinhibited so other inputs can excite it . . .
leading to excitation of D
Striatum
Globus pallidus
VA/VL complex of thalamus
Upper motor neuron in cortex

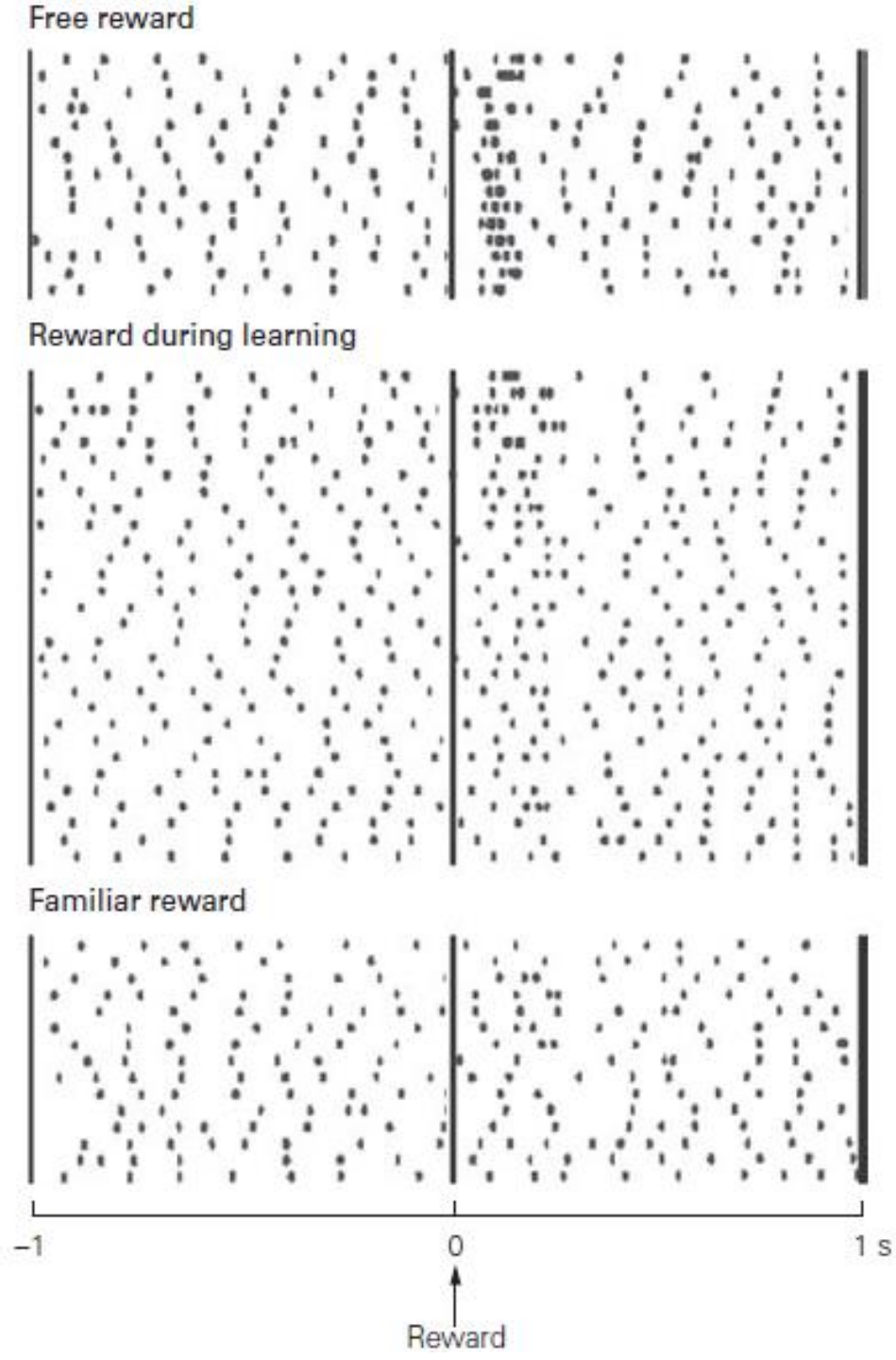

(A)
Caudate
Record
1
Substantia nigra
pars reticulata
Superior colliculus
Record
3
4
Record
2
Projections to horizontal
and vertical gaze centers
Caudate
1
Substantia nigra
pars reticulata
2
Superior colliculus
3
Eye movement
4

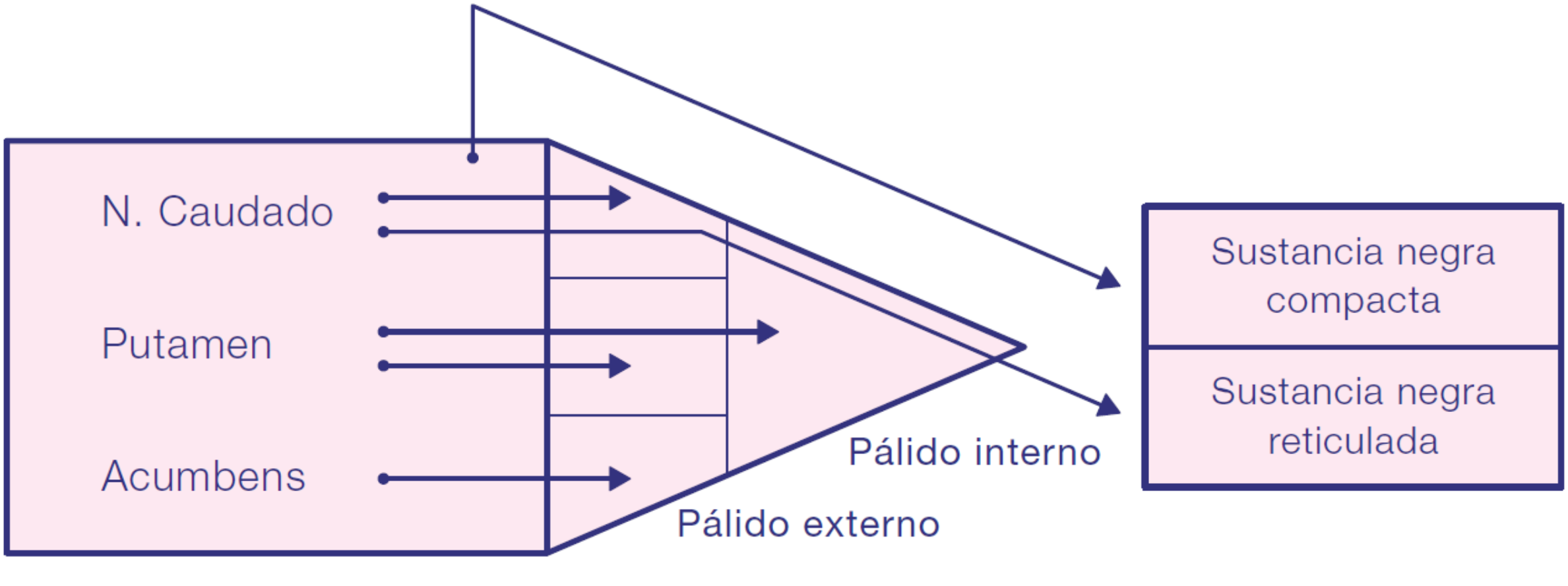
Action selection (in action)

- Multiple/ambiguous stimuli in our environment often demand our attention/action.
- However, we're often confined to making a single action to address these stimuli (e.g., a saccade).
- Selection through surround inhibition likely occurs on large and small scales – i.e., not only saccade left or right, but how far to saccade?

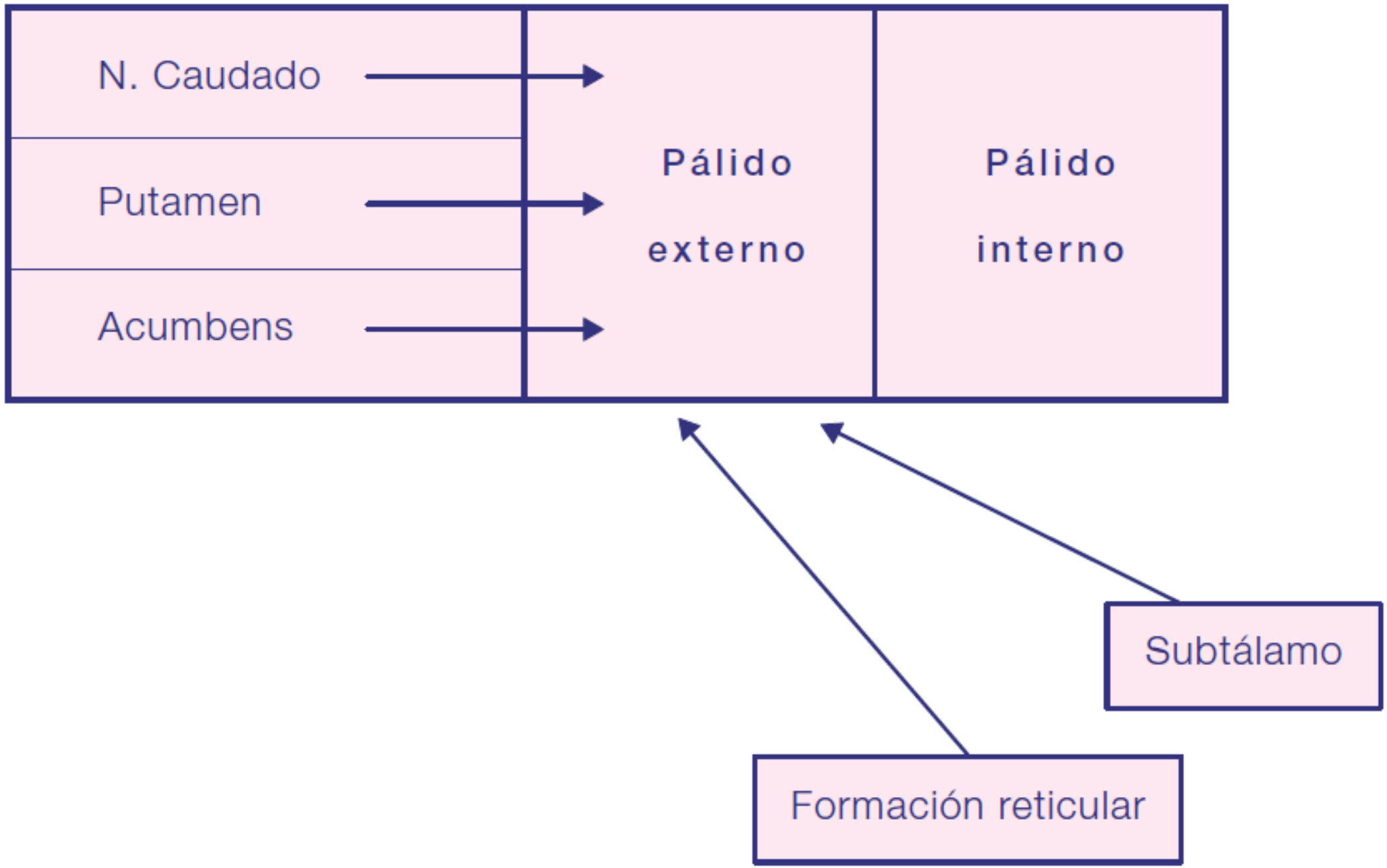


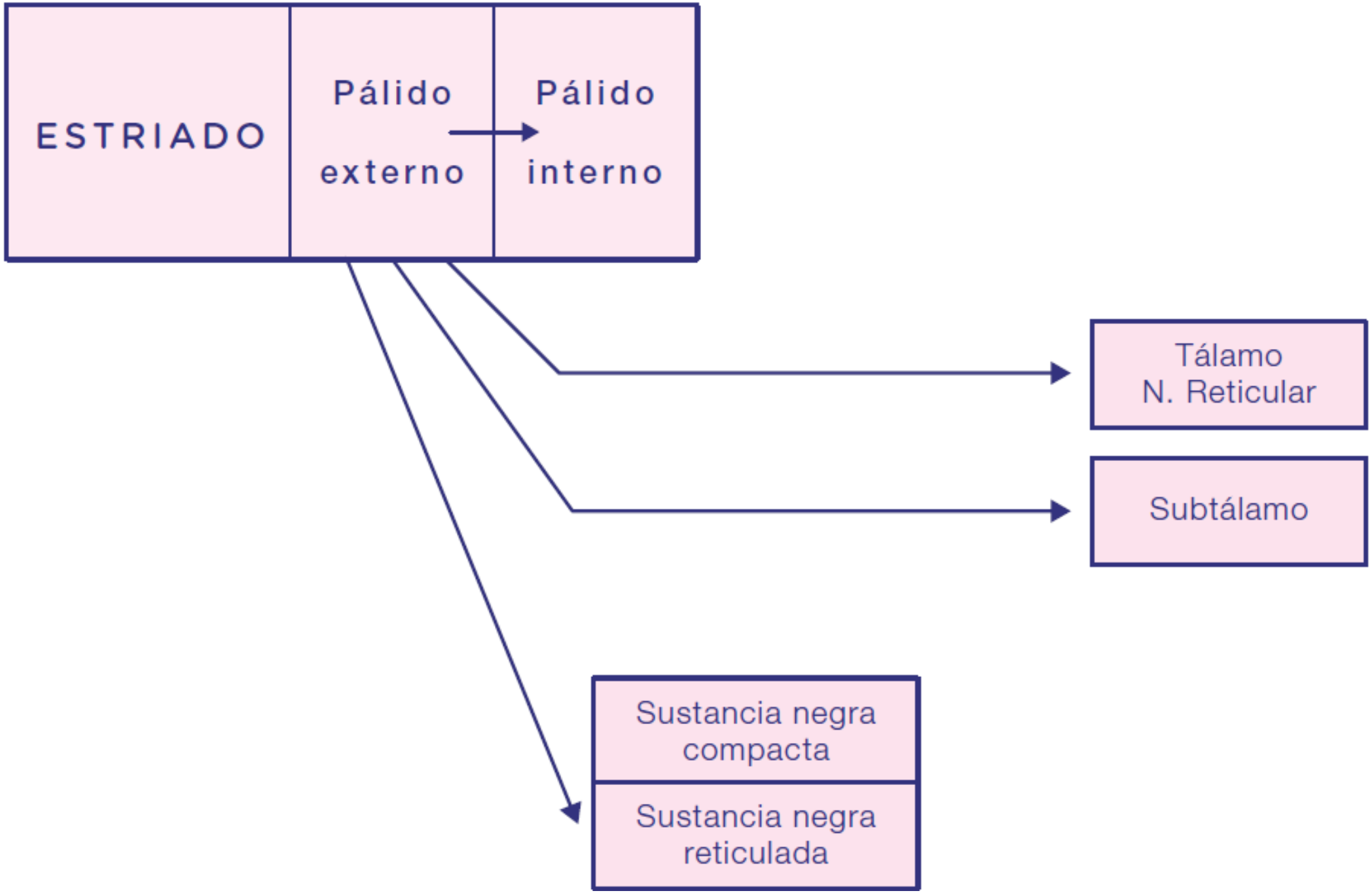

(B)
Target onset
Horizontal eye position
Vertical eye position
100 spikes per second per trial
0
400
800
1200
1600
2000
Time (ms)

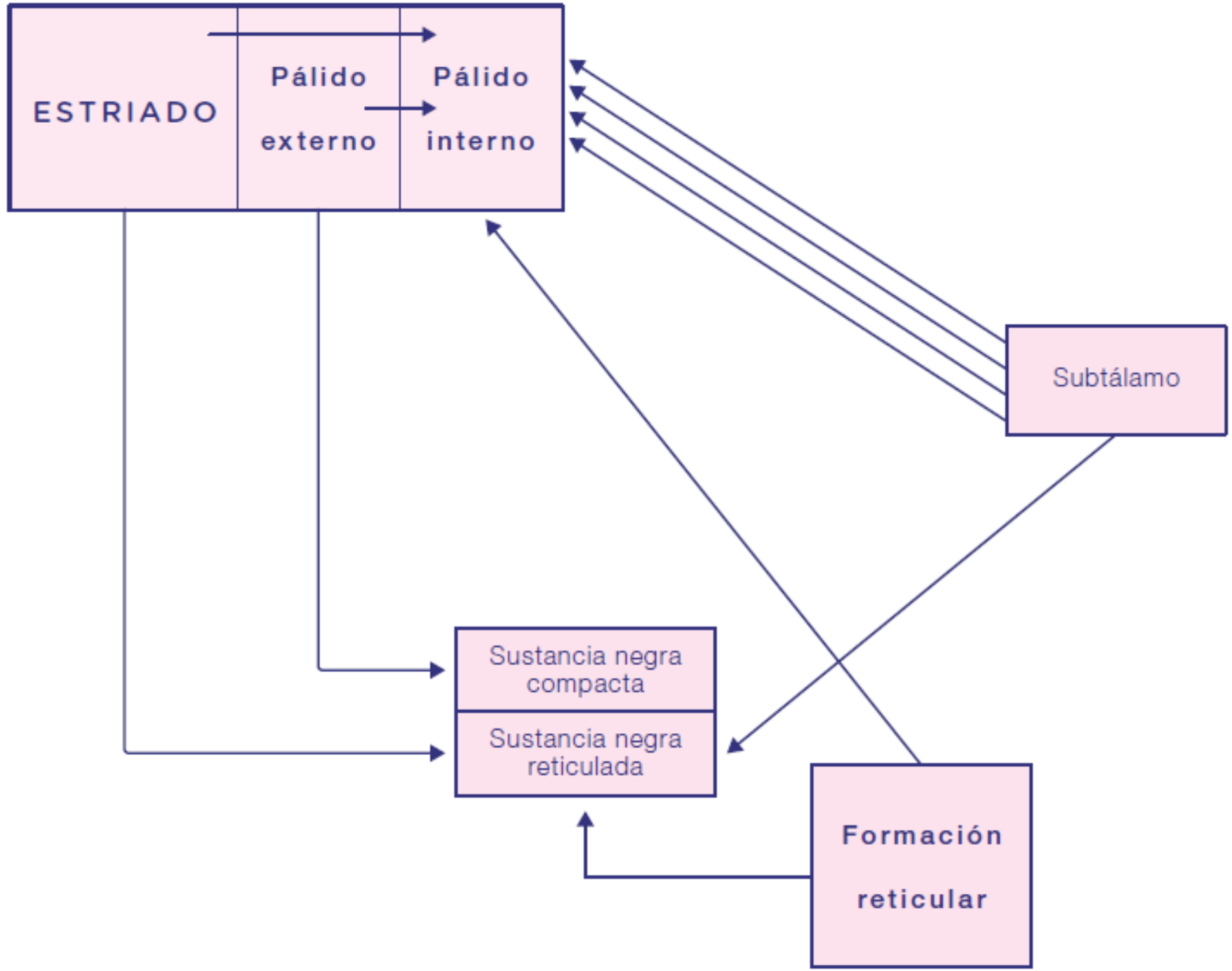

Free reward
Reward during learning
Familiar reward
–1
0
1 s
Reward

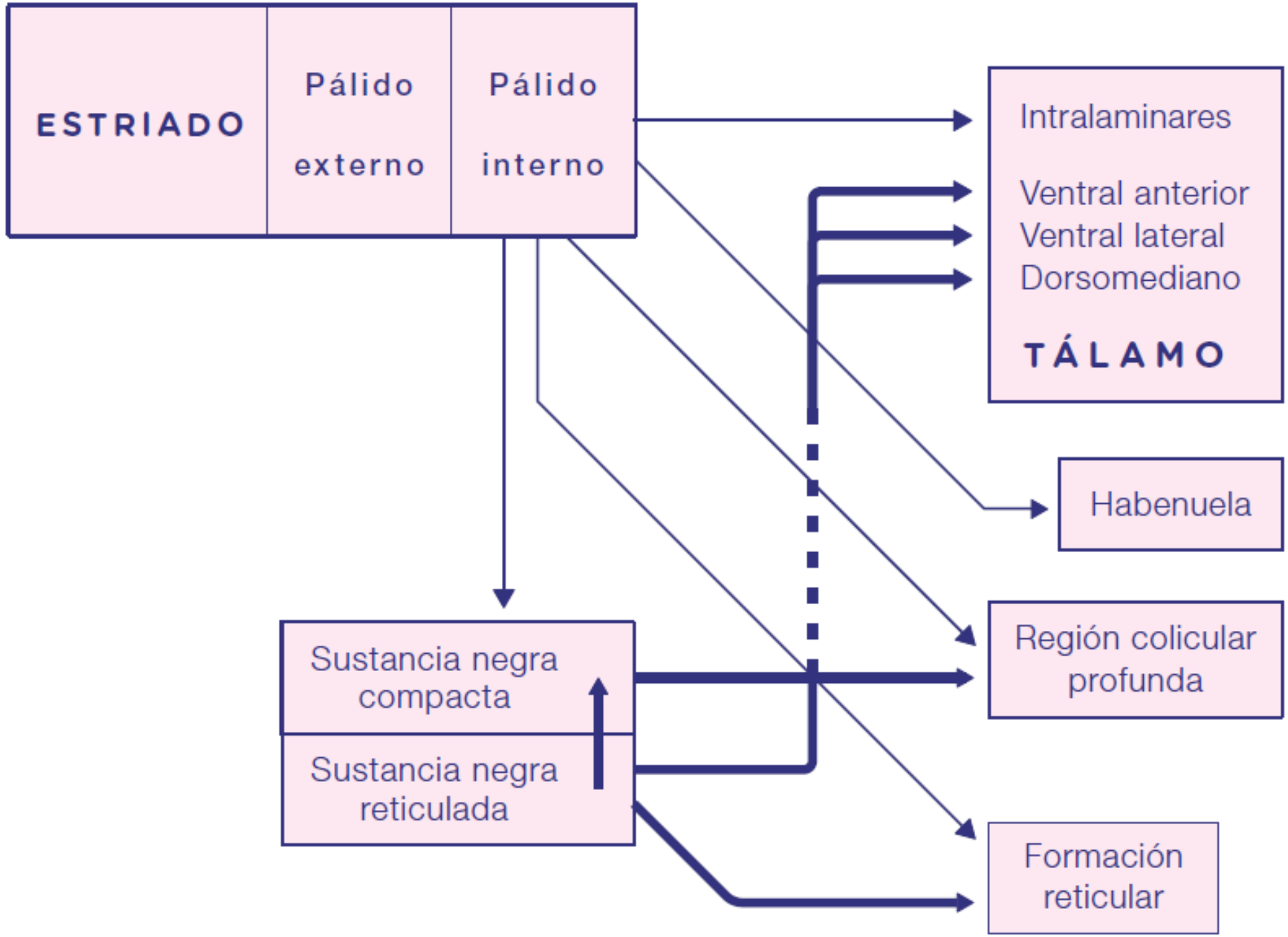

N. Caudado
Putamen
Acumbens
Pálido interno
Pálido externo
Sustancia negra compacta
Sustancia negra reticulada

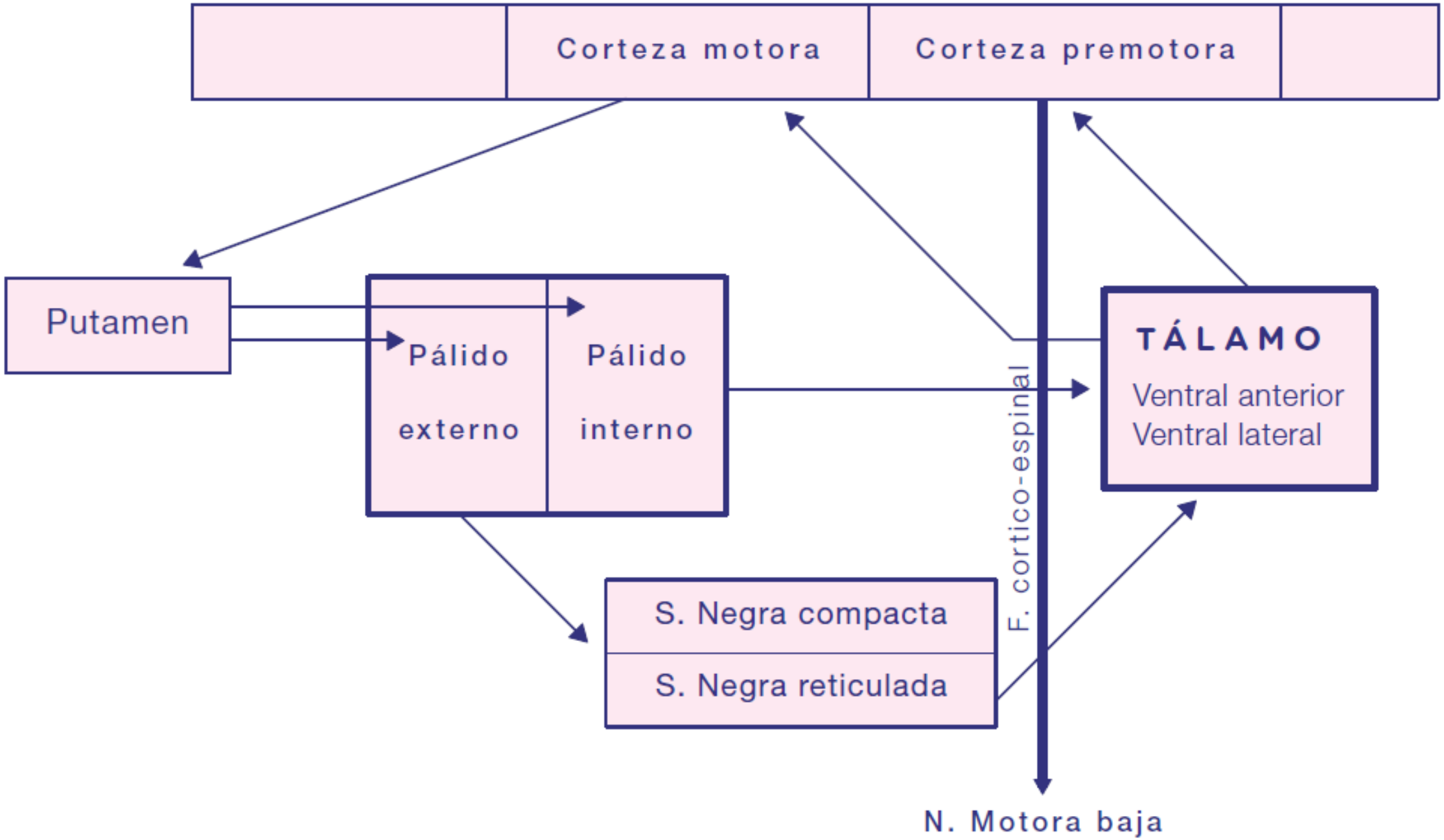
ESTRIADO

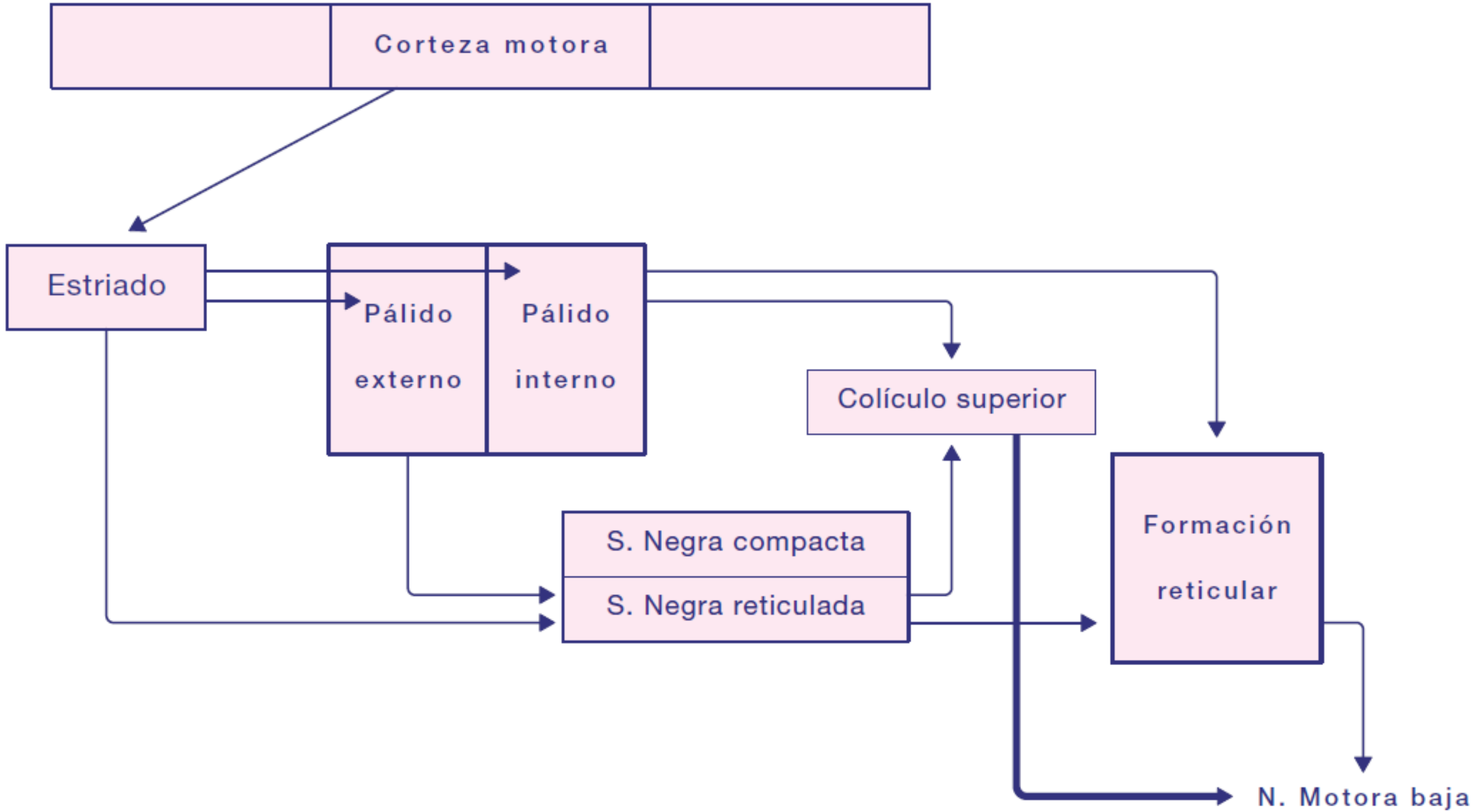

N. Caudado
Putamen
Acumbens
Pálido externo
Pálido interno
Subtálamo
Formación reticular

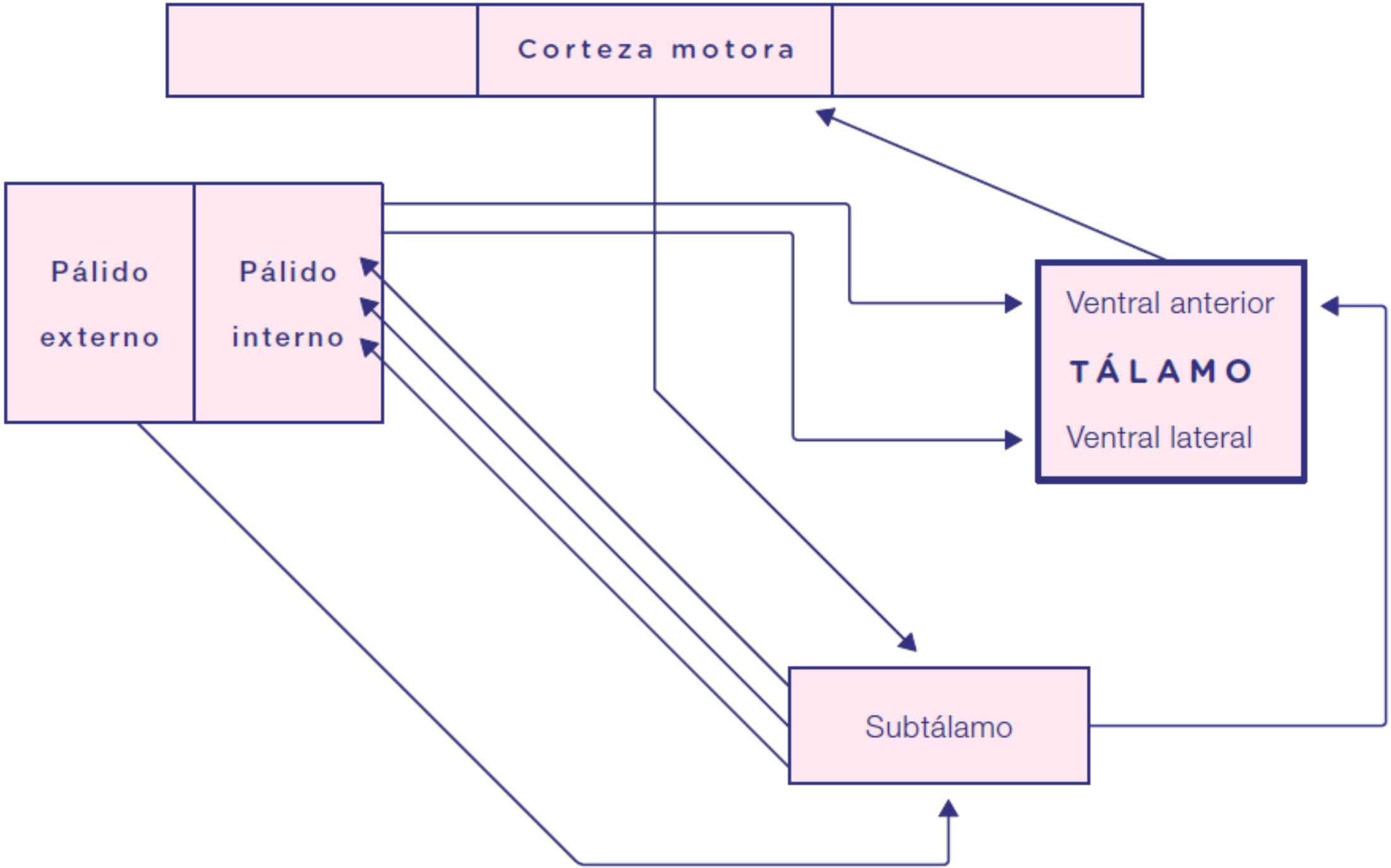

ESTRIADO
Pálido externo
Pálido interno
Tálamo
N. Reticular
Subtálamo
Sustancia negra compacta
Sustancia negra reticulada

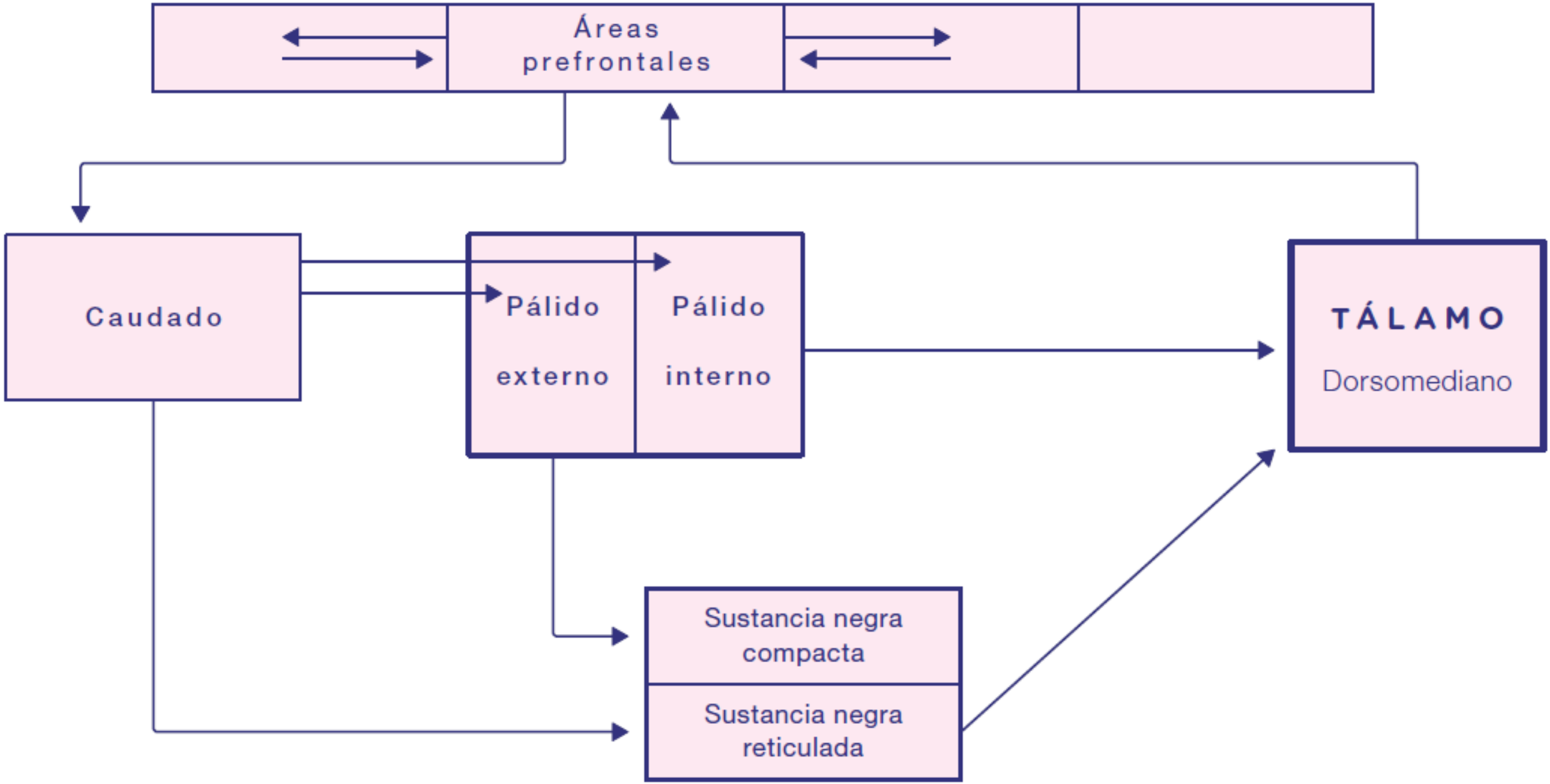

ESTRIADO
Pálido externo
Pálido interno
Subtálamo
Sustancia negra compacta
Sustancia negra reticulada
Formación reticular

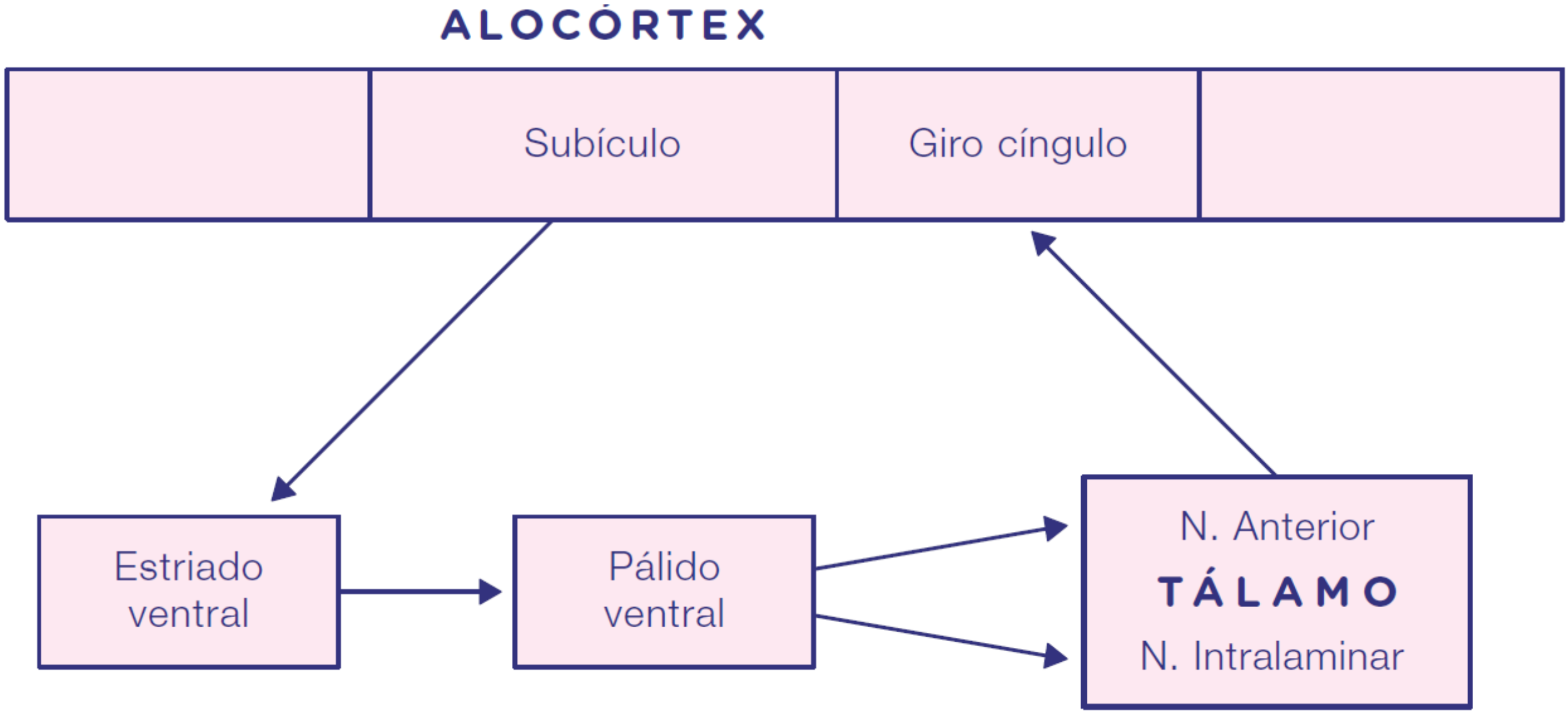

ESTRIADO
Pálido externo
Pálido interno
Intralaminares
Ventral anterior
Ventral lateral
Dorsomediano
TÁLAMO
Habenuela
Región colicular profunda
Sustancia negra compacta
Sustancia negra reticulada
Formación reticular

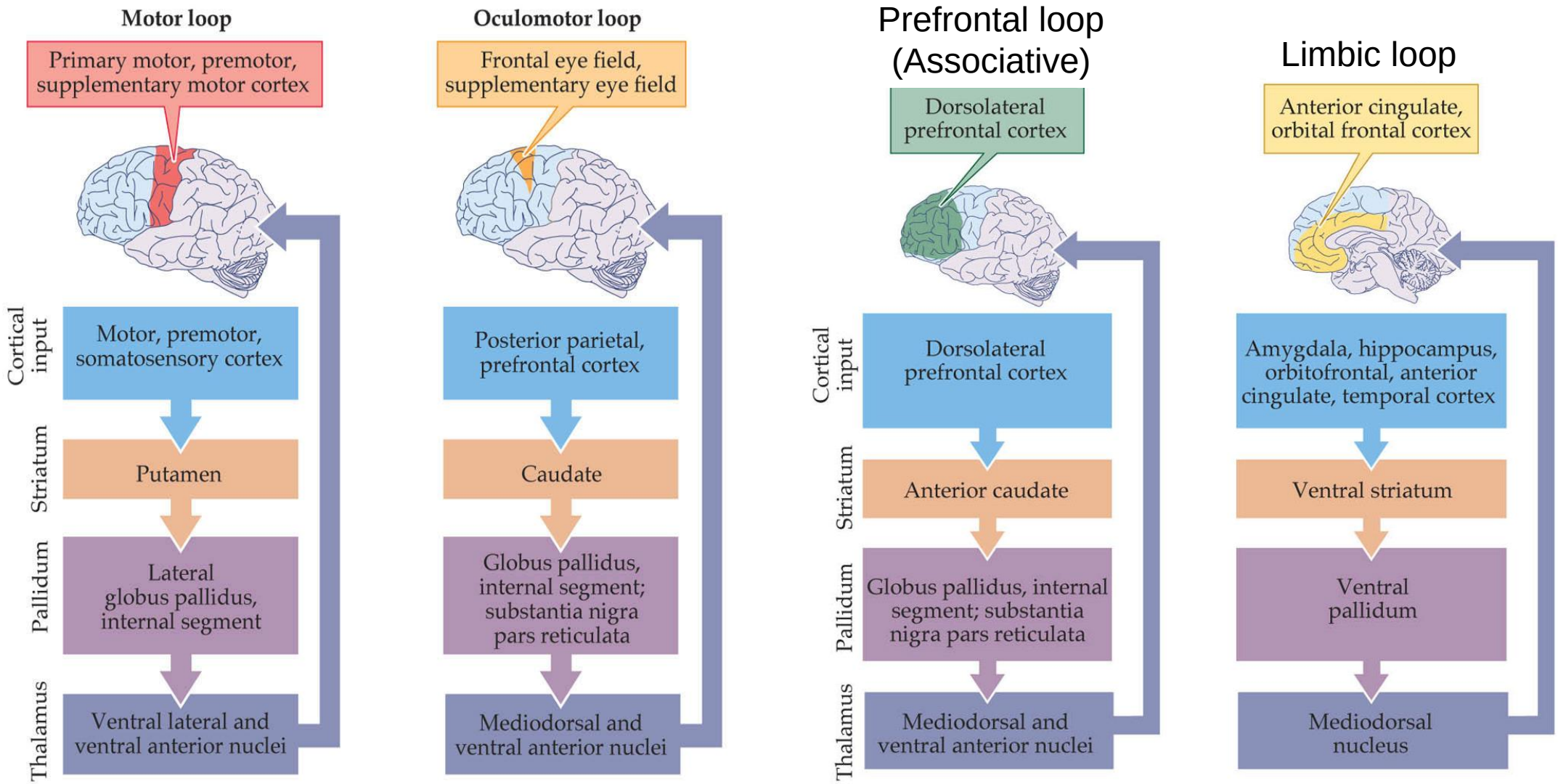

Corteza motora
Corteza premotora
Putamen
Pálido externo
Pálido interno
TÁLAMO
Ventral anterior
Ventral lateral
S. Negra compacta
S. Negra reticulada
F. cortico-espinal
N. Motora baja


Corteza motora
Estriado
Pálido externo
Pálido interno
Colículo superior
S. Negra compacta
S. Negra reticulada
Formación reticular
N. Motora baja


Corteza motora
Pálido externo
Pálido interno
Ventral anterior
TÁLAMO
Ventral lateral
Subtálamo

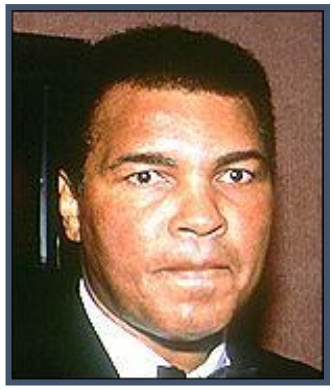

Áreas prefrontales
Caudado
Pálido externo
Pálido interno
TÁLAMO
Dorsomediano
Sustancia negra compacta
Sustancia negra reticulada


ALOCÓRTEX
Subículo
Giro cíngulo
Estriado ventral
Pálido ventral
N. Anterior
TÁLAMO
N. Intralaminar



Parkinson's disease

Michael J. Fox



Muhammad Ali

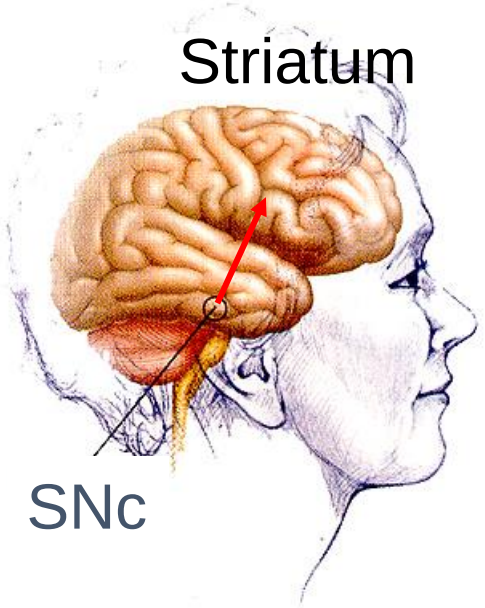
Pope John Paul II

Janet Reno

Katherine Hepburn

Pathophysiology

Primary: loss of nigrostriatal DA projection

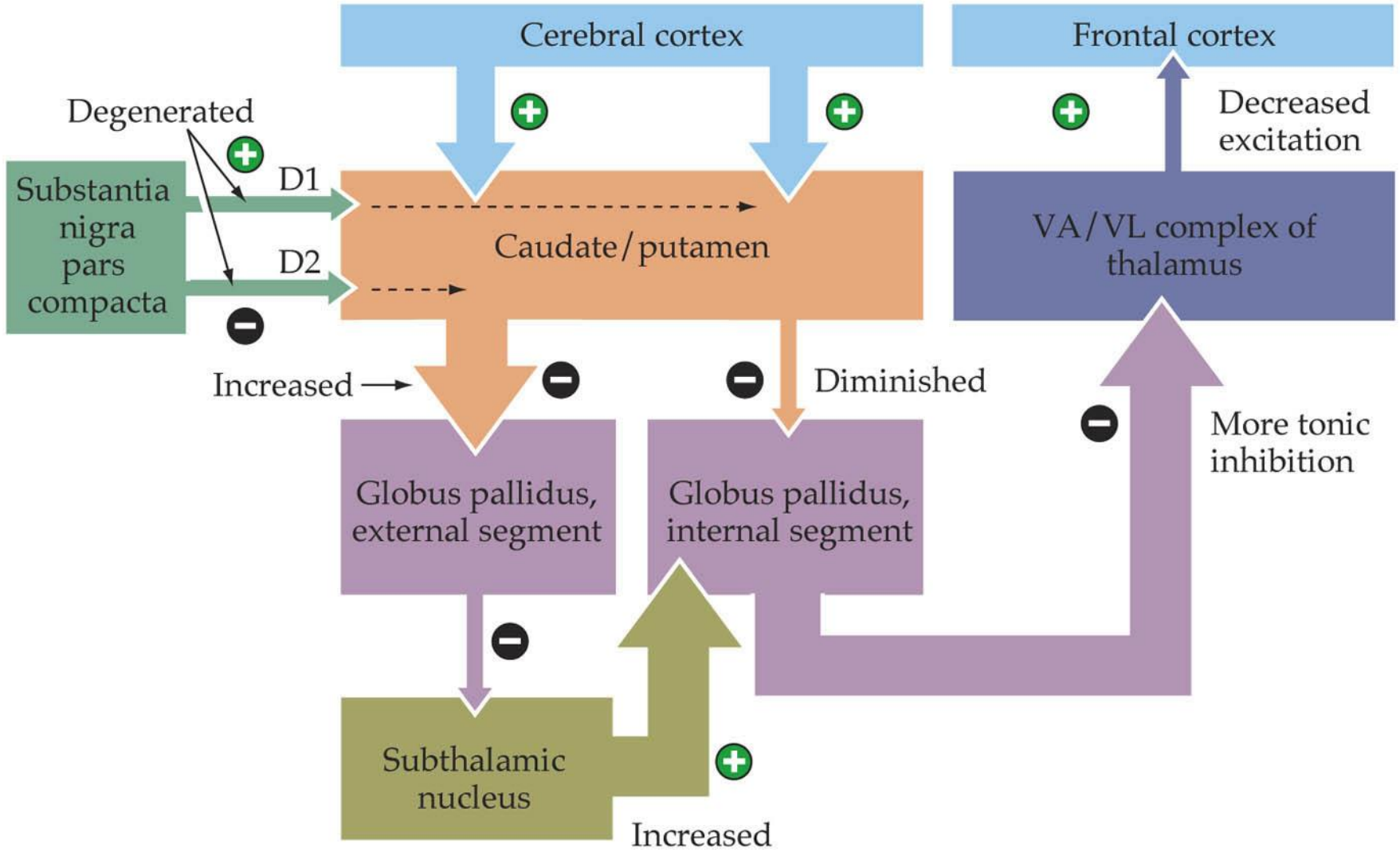


Human midbrain

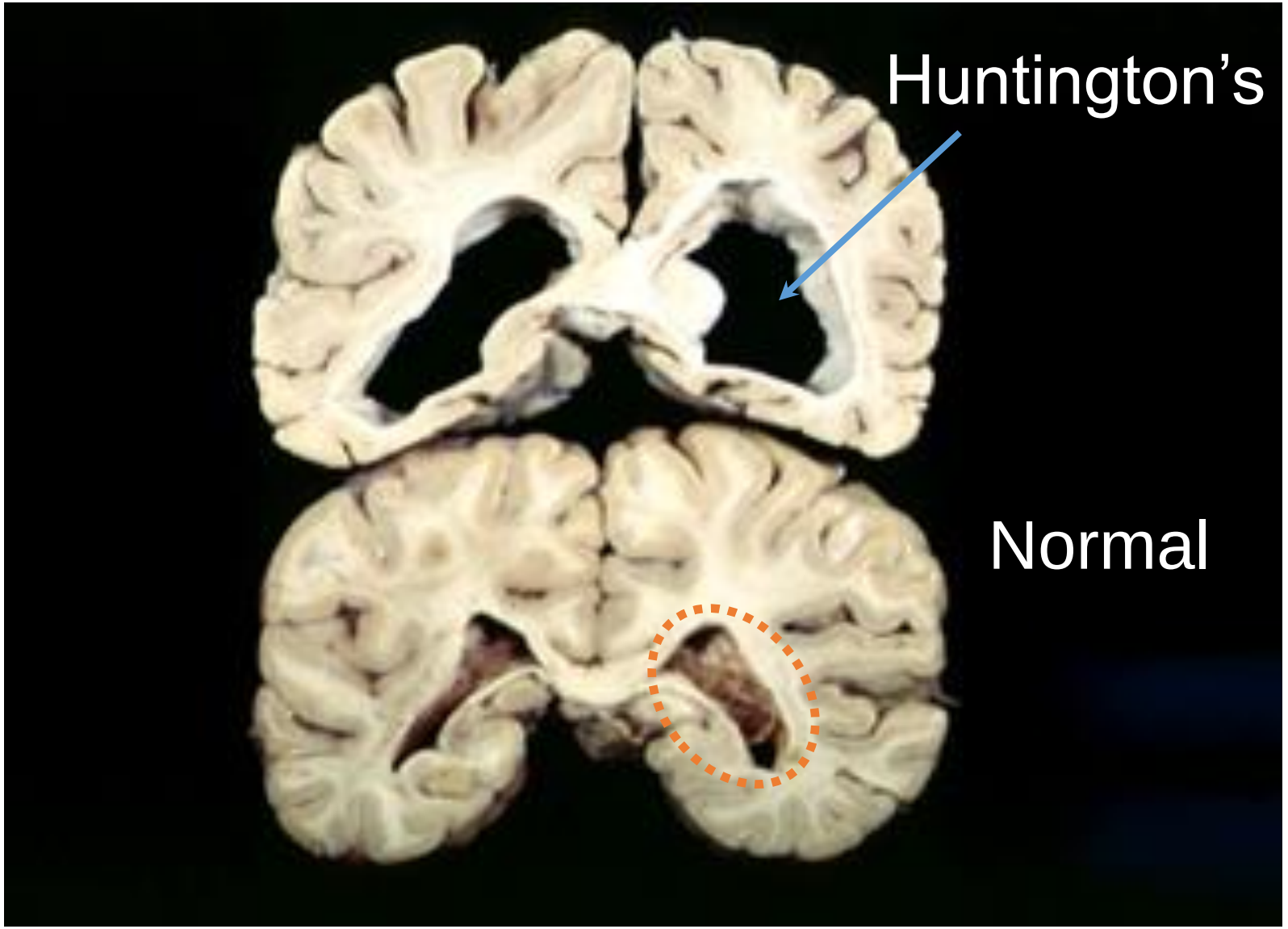
Parkinson's disease

Normal

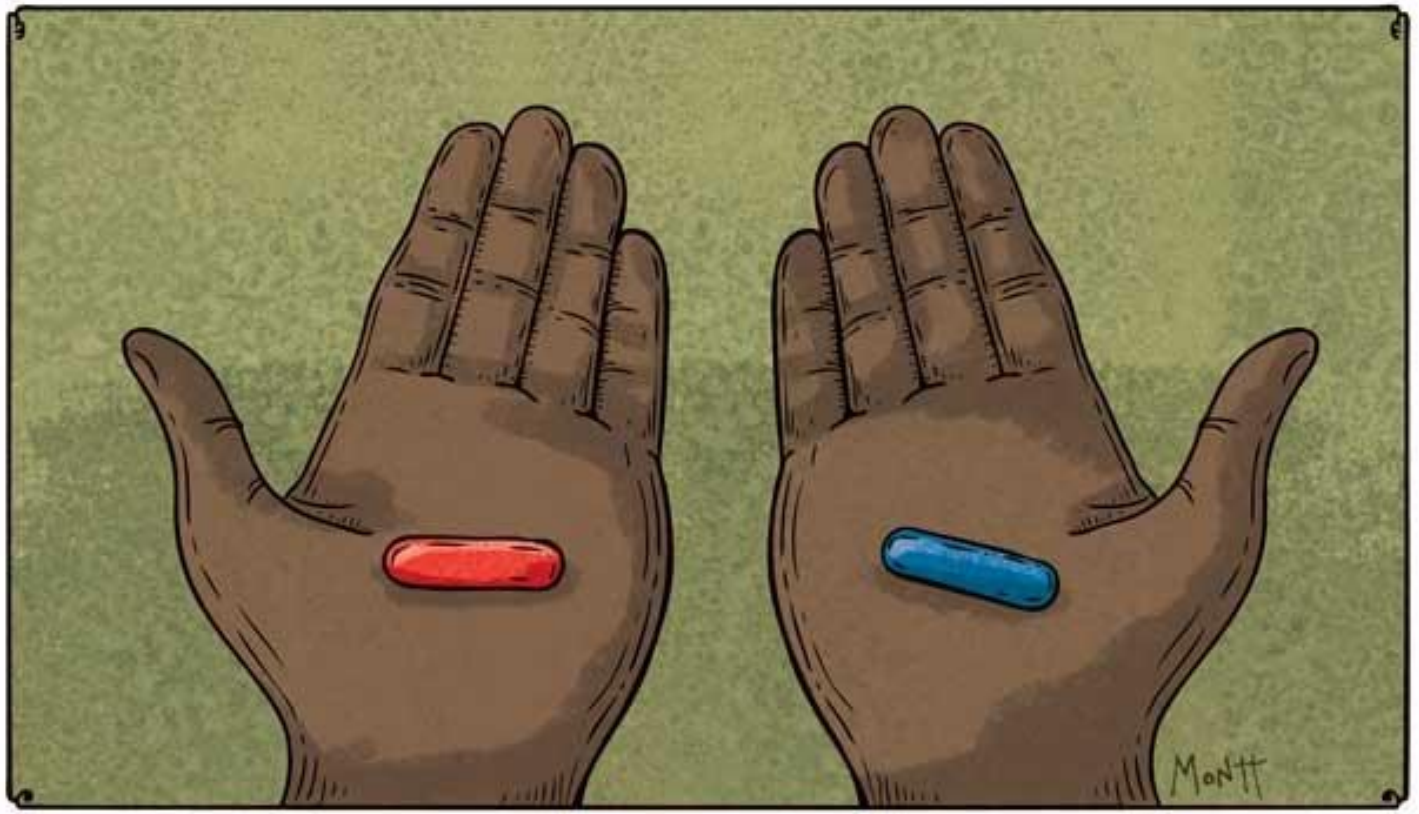
Parkinson's disease



Huntington’s disease pathology



..SI TOMAS LA PÍLDORA ROJA, PODRÁS VER LA REALIDAD TAL Y COMO ES...



¿LA PÍLDORA AZUL?... NADA, SOLAMENTE ES EL ANTIDEPRESIVO
QUE VAS A NECESITAR DESPUÉS DE TOMAR LA PÍLDORA ROJA.

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