Understanding Action

Active Learning Session #1

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COCO

Sensory systems:

- Vestibular, Visual, Proprioception

Motor system

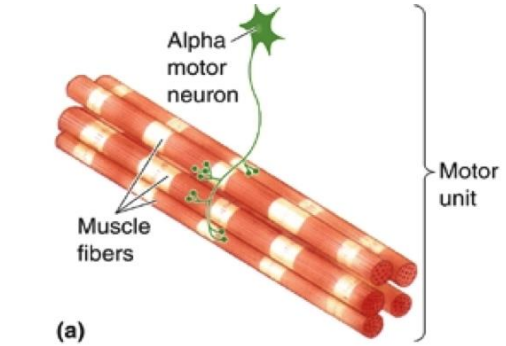
Intelligent: Exploration, Memory, Learning

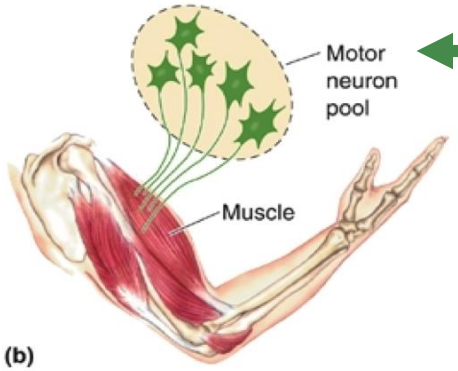
How does brain function control action?
What happens in brain dysfunction?

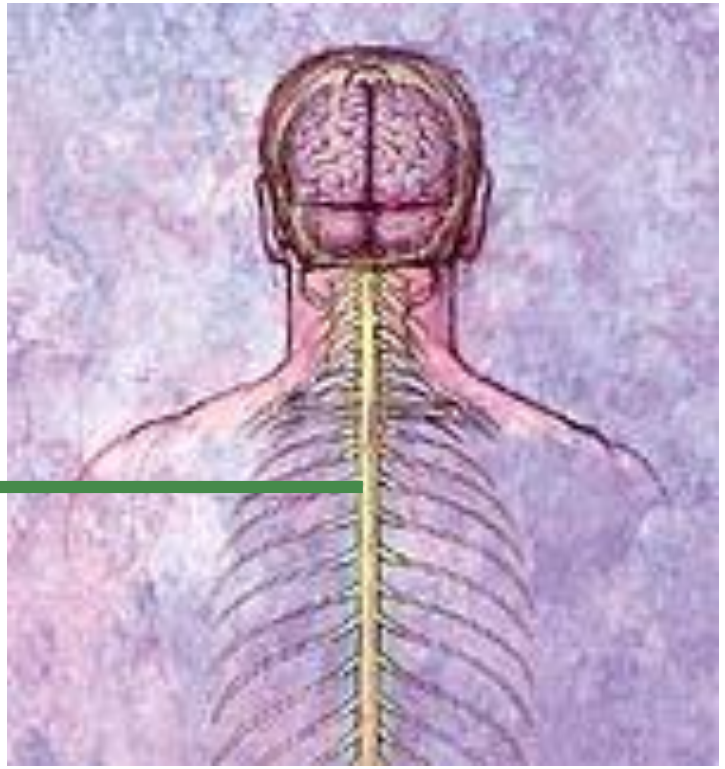
Hint #1:

"… to move things is all that mankind can do, for such the sole executant is muscle, whether in whispering a syllable or in felling a forest."

Sir Charles Sherrington

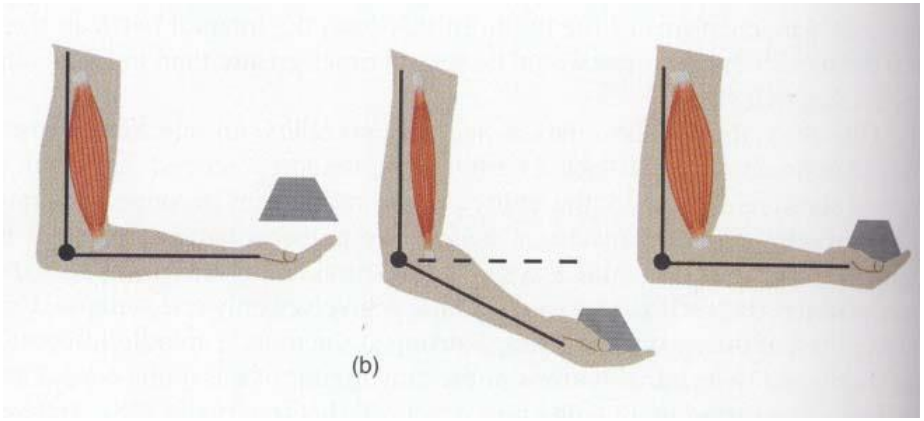


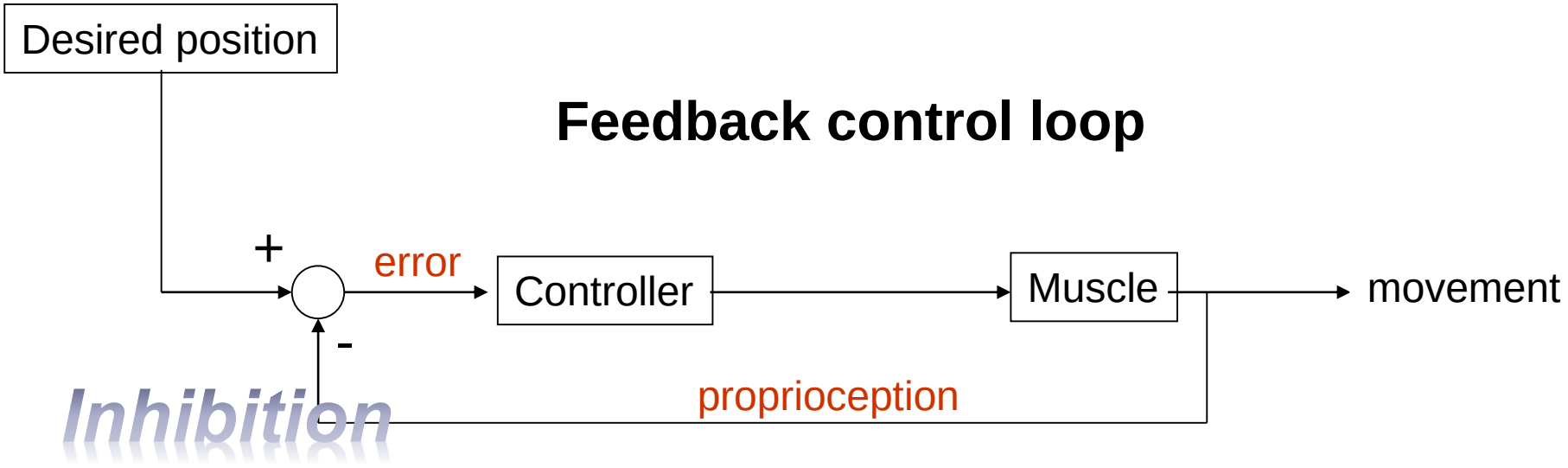




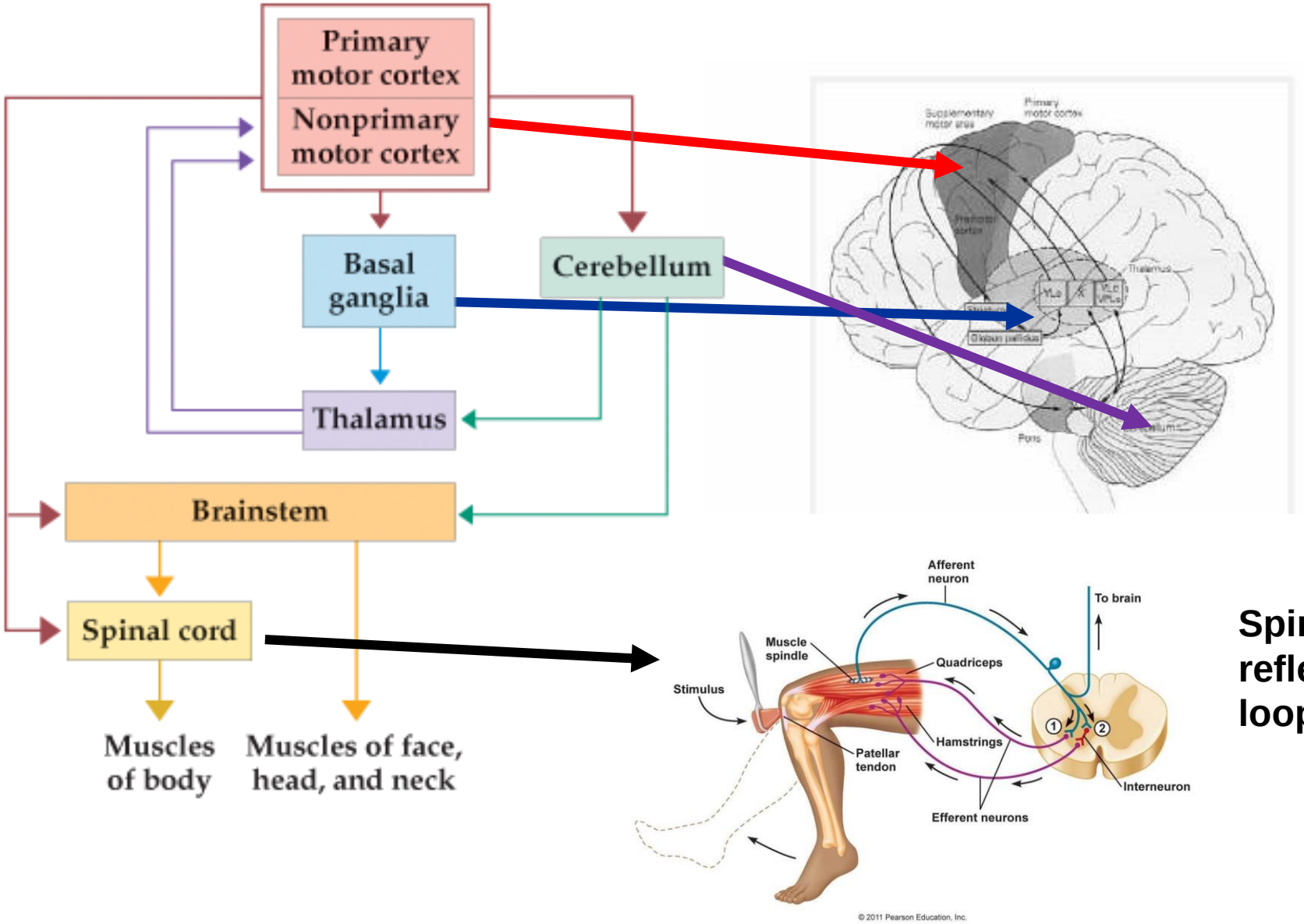
Hint #2:

Is excitation alone enough for achieving coordinated motion?

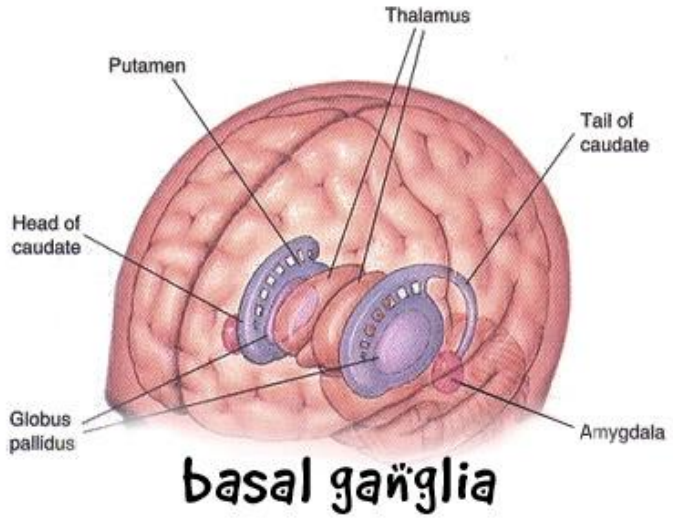




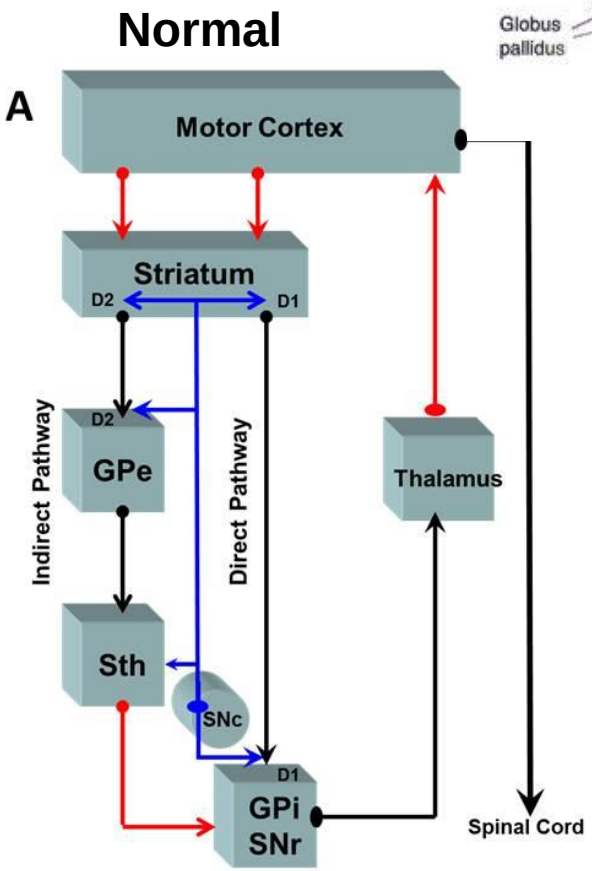
Motor System major control loops



Spinal reflex loops



Striatum: Caudate, Putamen…
Globus Pallidus:
external (GPe), internal (GPi)
Substantia Nigra:
Reticulata (SNr), Compata (SNc)
Subthalamic nucleus (Sth)



<u>Your goal now is to reveal the effect of Parkinson's Disease on this circuit</u>

Hint #1: Normal circuit (+movie)

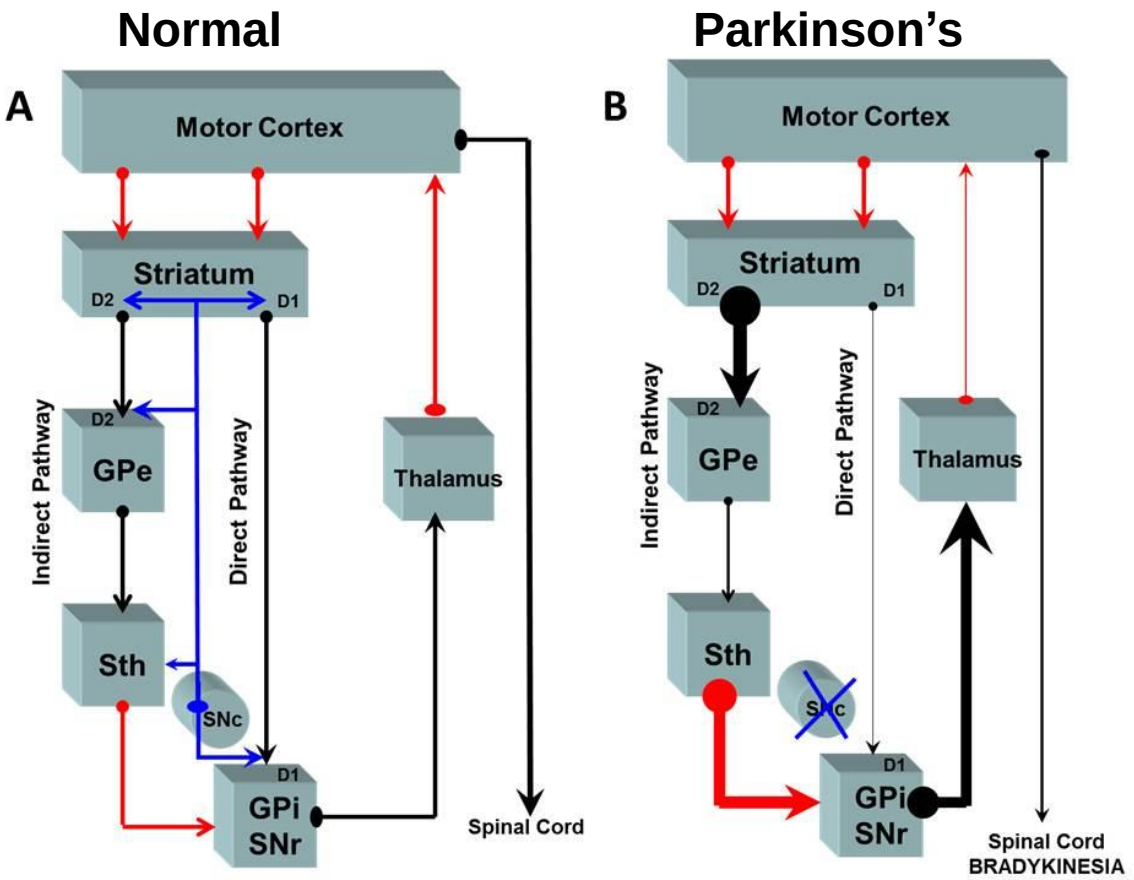
Hint #2: Physiological/Biochemical studies reveal that PD leads to lack of Dopamine production increasing the activity of D2 pathway.

Hint #3: Bradykinesia symptom

Red – excitation **Blue – Dopamine (modulator) targets**
Black - Inhibition

Solution + Explanation

Followup: Which areas would you knock-out?



Red – excitation **Blue – Dopamine targets**

Black - Inhibition

Without Dopamine, the indirect pathway so hyperexcited. The basal ganglia inhibit the Thalamus and thus they suppress cortex and the motor output.

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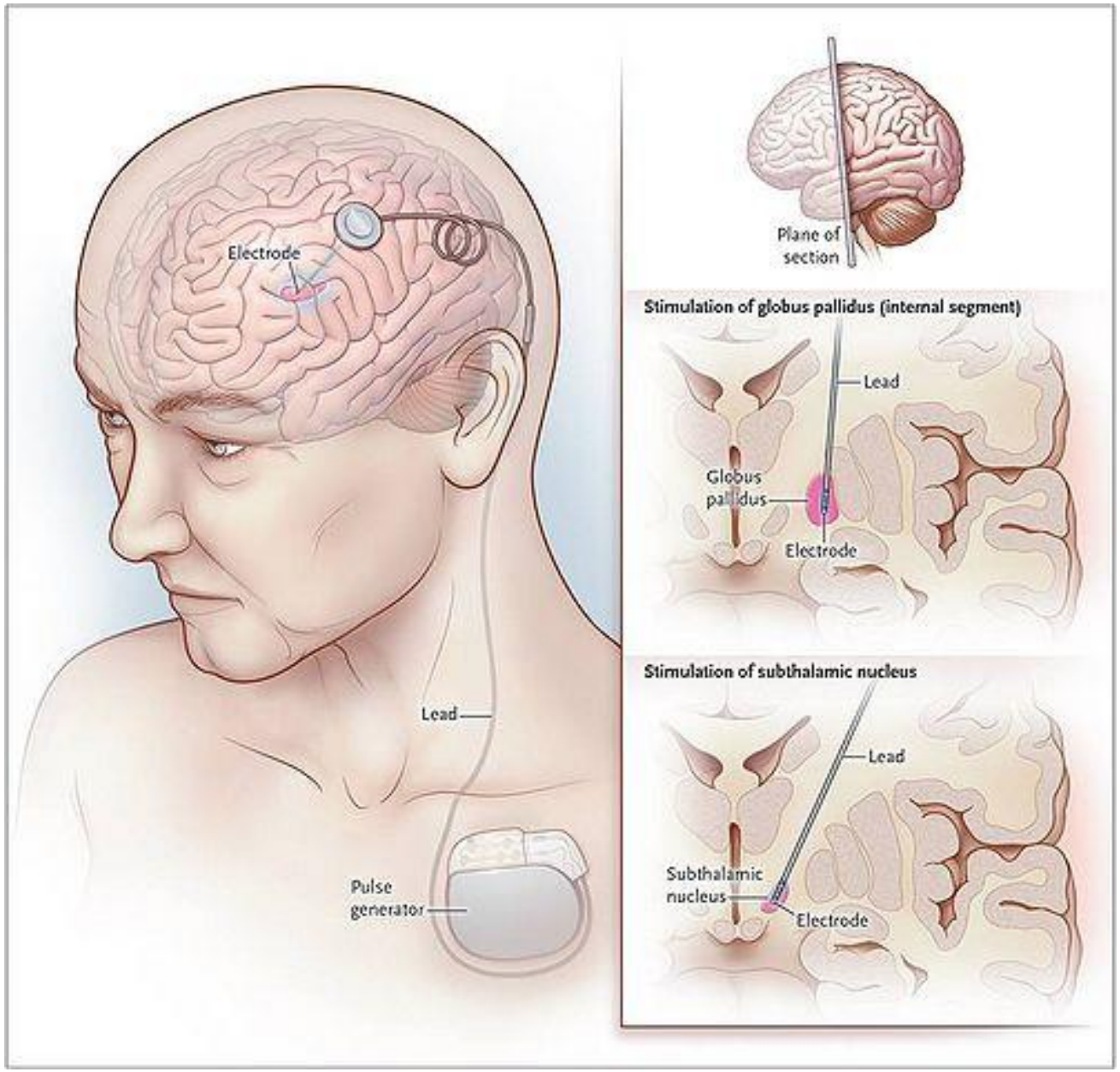
Deep Brain Stimulation (DBS)



Concepts visited

Motor unit

Feedback control loop

Excitation & Inhibition

Spinal reflex

Basal ganglia

Thalamus

Parkinson’s Disease, Bradikinesia

Deep Brain Stimulation