

Deep brain stimulation

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Abstract

- *Parkinson's disease*
 - *Degenerative disorder of the central nervous system that often impairs the sufferer's motor skills and speech.*
 - *Parkinson's disease belongs to a group of conditions called movement disorders. It is often characterized by muscle rigidity, tremor, a slowing of physical movement (Bradykinesia /Hypokinesia), and in extreme cases, a loss of physical movement (Akinesia).*
- *Deep brain stimulation for controlling movement disorder*
 - *Unexpectedly, in 1962, investigating the treatment of deafferentation pain with intermittent electrical stimulation, Mazars and colleagues could control associated abnormal movements.*
- *Targeting specific structures within basal ganglia*
 - *Subthalamic nucleus (STN) or the internal segment of the globus pallidus (GPi)*
- *The effect of high frequency stimulation through DBS*
 - *Still not fully explained*
 - *Mimicking the functional effects of ablation in various brain structures.*

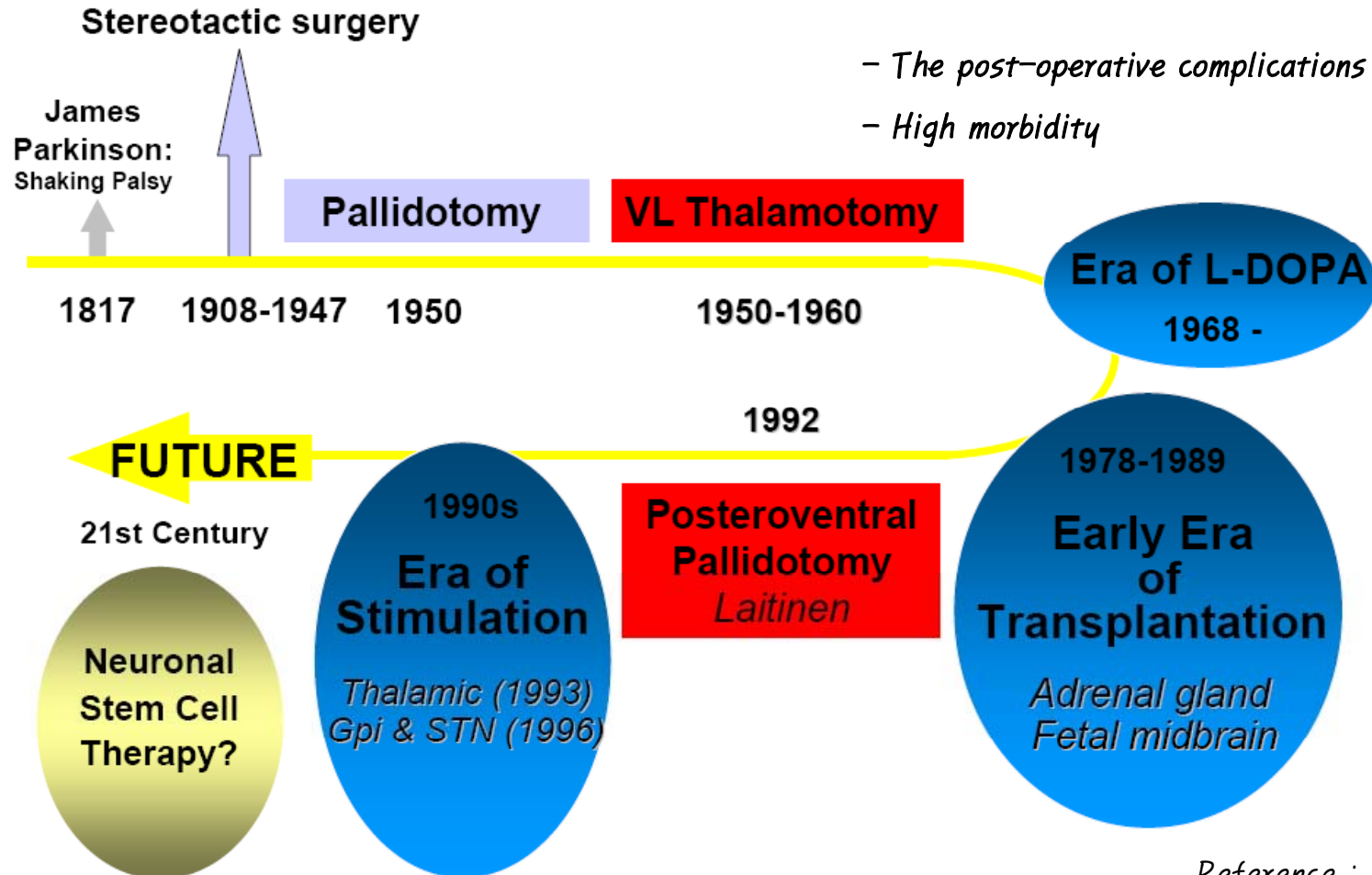
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1. History of surgical treatment and deep brain stimulation for Parkinson's diseases



- The post-operative complications
- High morbidity

Reference : ph. D. Se-ik Park's presentation



2. Pathophysiological basis for surgery for Parkinson's disease

2-1. basal ganglia activity model

Striatum :

- 1- Putamen
- 2- Caudate
- 3- Nucleus Accumbens (ventral striatum)

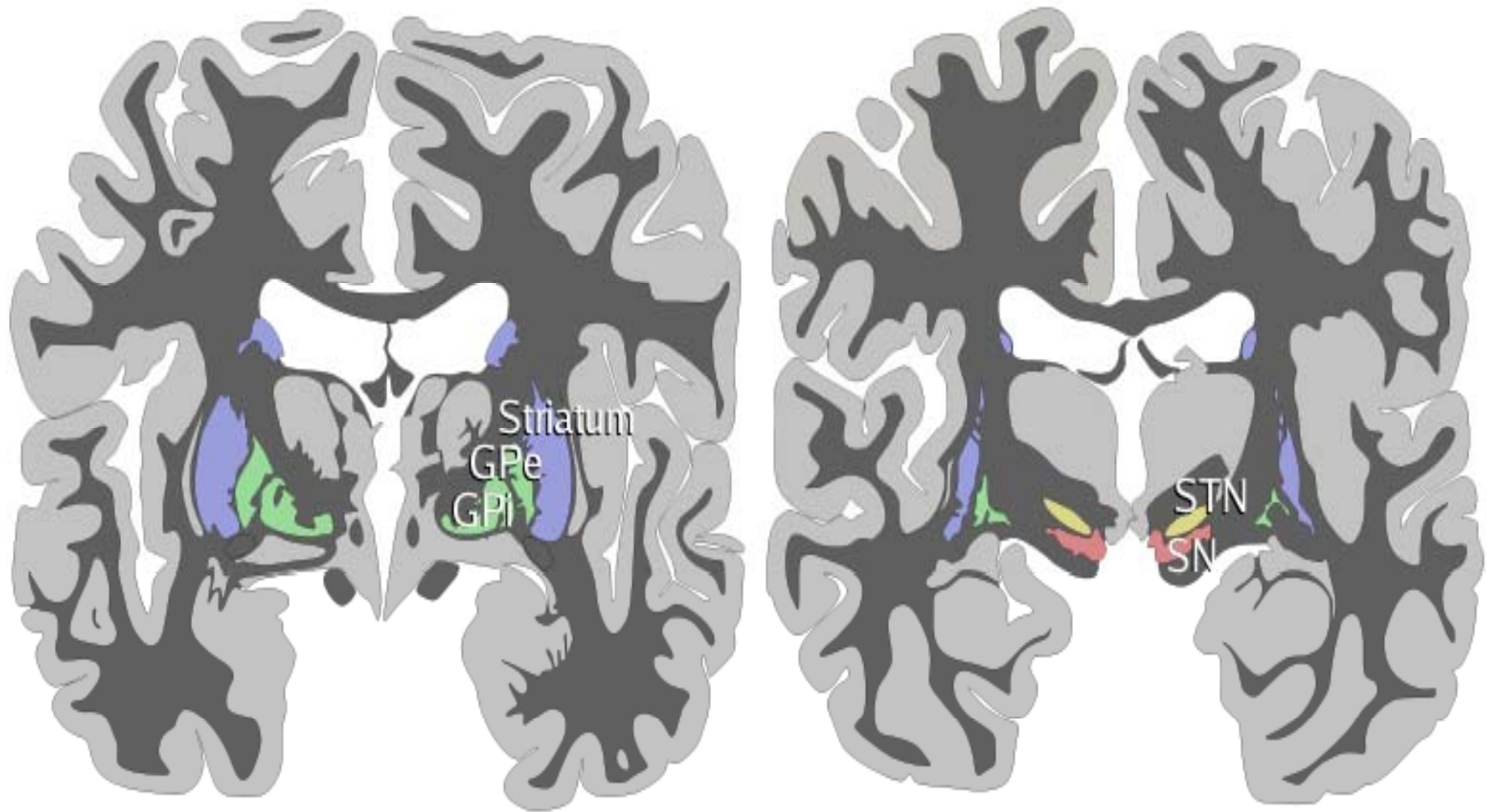
Pallidum :

- 1- Globus Pallidus internus
- 2- GP externus
- 3- Substantia Innominata (ventral pallidum)

Other nuclei :

- 1- Substantia Nigra pars reticulata
- 2- SN pars compacta
- 3- SubThalamic Nucleus (STN)

Fig. Coronal Slices of human brain



Reference :

http://en.wikipedia.org/wiki/Subthalamic_nucleus

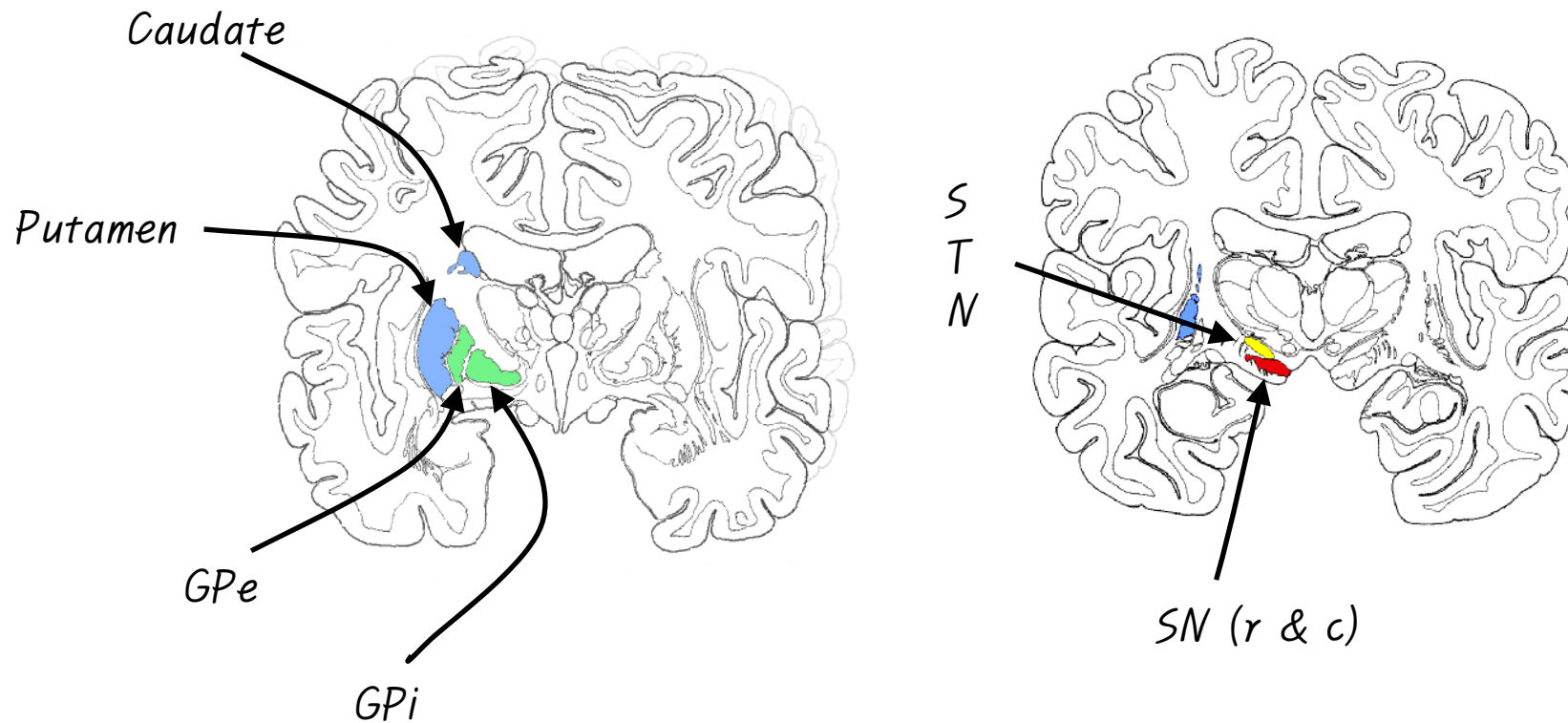
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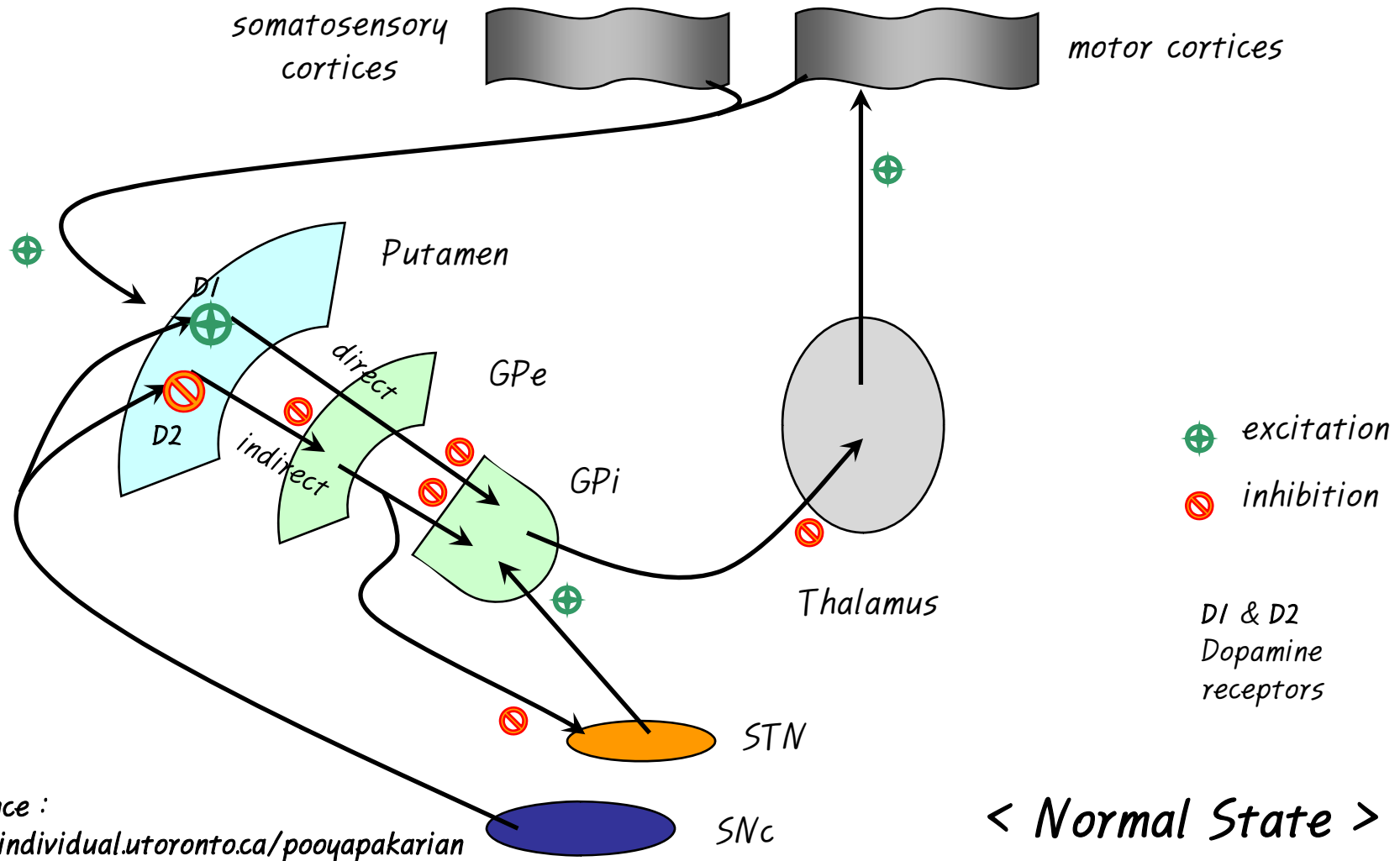
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2-1. basal ganglia activity model (cont' d)



Reference :
<http://individual.utoronto.ca/pooyapakarian>

2-1. basal ganglia activity model (cont' d)



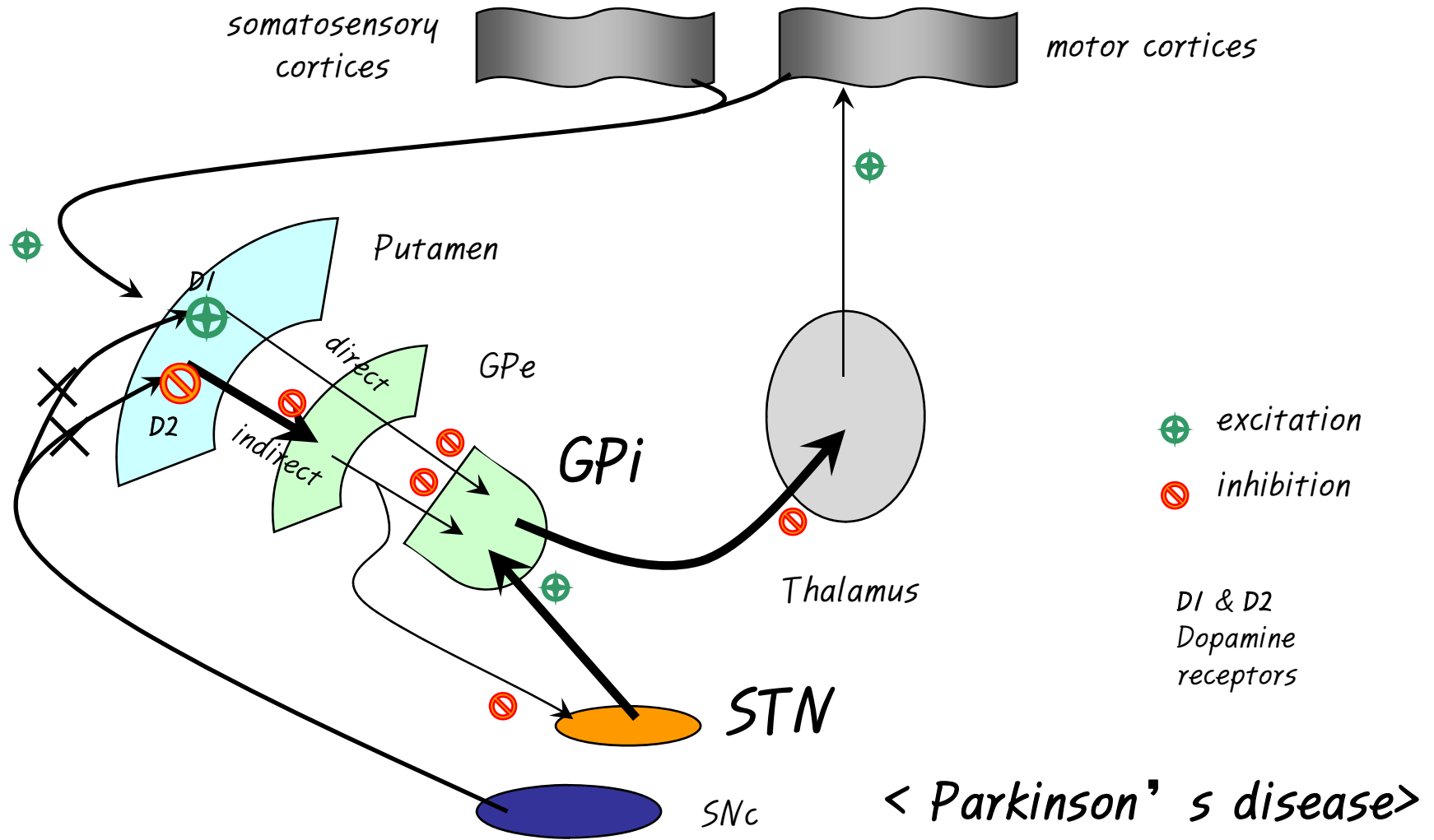
Reference :
<http://individual.utoronto.ca/pooqapakarian>

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2-1. basal ganglia activity model (cont' d)



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2-2. The reasons for symptoms in Parkinson's Disease

- *Bradykinesia / Hypokinesia*
 - Well-established excessive output activity of the GPi/SNr
- *Tremor*
 - Loss of the normal parallel activity of the subcircuits and encourage abnormal synchronicity of part or all of the basal ganglia system
- *Other involuntary movements*
 - Action selection model

2-3. Side effects of Medical Therapy(L-dopa) for Parkinson' s Disease

- *Motor fluctuations*
 - "On" periods
 - "Off" periods

- *Dyskinesia: abnormal involuntary movements*

- *Neuropsychiatric problems*

3. Patient selection

- *L-DOPA responsive with slowness of movement, tremor, freezing, and/or rigidity*
- *People for whom improvement in movement will improve quality of life*
- *People with dose-limiting side effects of L-DOPA and dopamine agonist therapy*
 - *L-DOPA induced dyskinesias often respond dramatically*
- *General health conditions*

4. Technical approach and optimal site of stimulation

4-1. Technique for predetermining target region

- *Steps for defining the target region.*
 1. *The definition of the ‘theoretical’ anatomical target.*
 2. *Refining the target by intra-operative electrophysiological techniques.*

- *‘Theoretical’ anatomical target*
 1. *Why ‘Theoretical’ ?*
 - *The location cannot be defined with 100% accuracy in all patients.*
 - *Complex internal topology.*
 2. *Techniques for ‘Theoretical’ anatomical targeting*
 - *direct positioning visualization with MRI and CT*
 - *indirect positioning technique*
 - *a combination of the two*

4-1. Technique for predetermining target region (Cont' d)

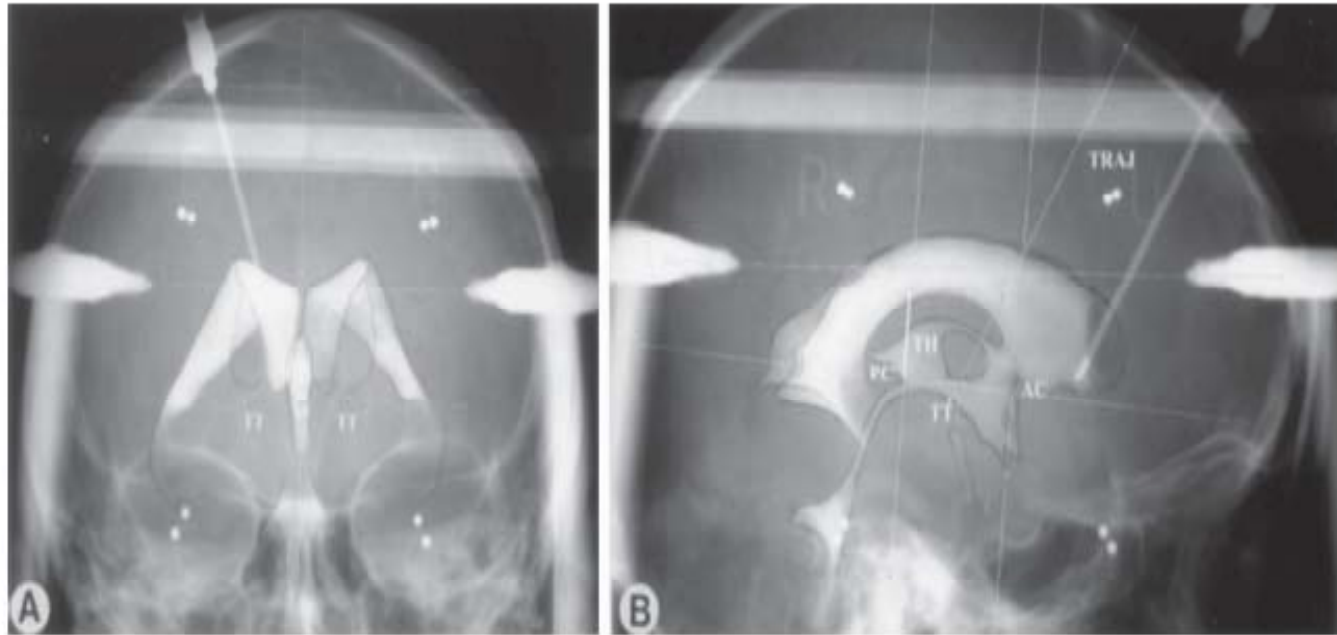


FIG. 3. Anteroposterior (A) and lateral (B) ventriculograms showing the theoretical subthalamic nucleus target (TT), anterior commissure (AC), posterior commissure (PC), thalamic height (TH) and initial target trajectory (TRAJ).

Reference : K. ASHKAN, B. WALLACE, B. A. BELL & A. L. BENABID, "Deep brain stimulation of the subthalamic nucleus in Parkinson's Disease 1993 - 2003: where are we 10 years on?," *British Journal of Neurosurgery*, 18(1), pp19-34, February 2004.

4-2. Intra-operative technique

- *Electrophysiological exploration (intra-operative)*

- *Micro-recording*

- . *Pro*

- Increased confidence in correct target localization*
 - The absence of evidence-based support of an increased bleeding risk.*

- . *Con*

- The potential increased risk of hitting a blood vessel, The increased operation time*
 - The limited information gain achieved*

- *Test-stimulation*



Reference :

http://en.wikipedia.org/wiki/Image:Parkinson_surgery.jpg

Some AVI files



Explanation of DBS.avi



DBS_process.avi

DBS clinical therapy

DBS Stimulation – 3D



Before_After.avi

Before & After of DBS

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*Thank you ~**

Q&A

