

Deep Brain Stimulation Surgery for Parkinson's Disease

Demystifying Medicine

24 January 2012

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NINDS



Surgery for Parkinson's Disease

Medically refractory PD

Thalamotomy (VIM/VOP)

Tremor suppression

Risks of speech impairment, memory loss, and hemiparesis

Pallidotomy (Posteroventral)

Rigidity and bradykinesia

Risks of visual deficit and speech impairment



Indications

FDA approved for:

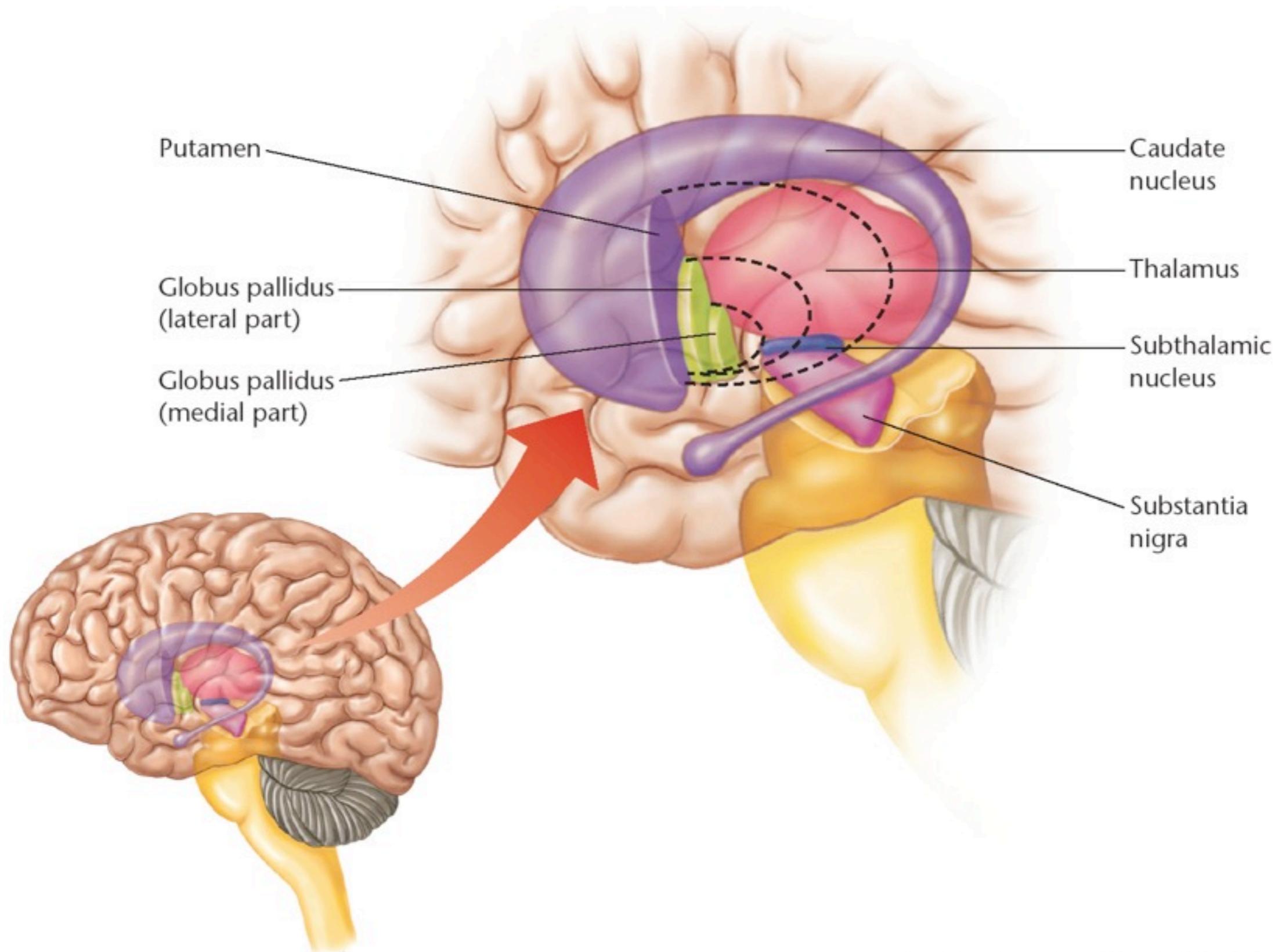
Parkinson's Disease (2002)

Essential Tremor (1997)

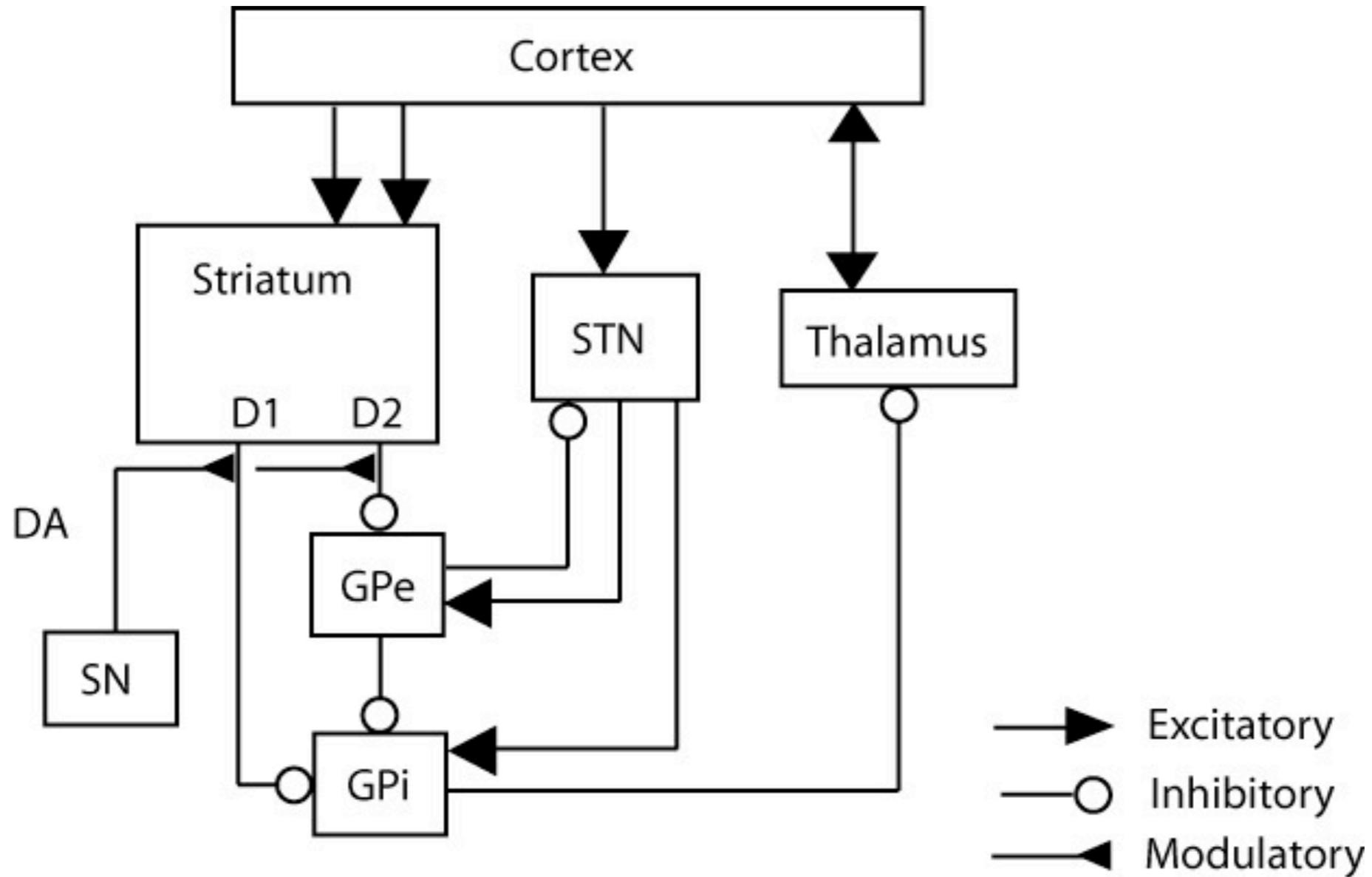
Dystonia (2003)

OCD (HDE 2009)

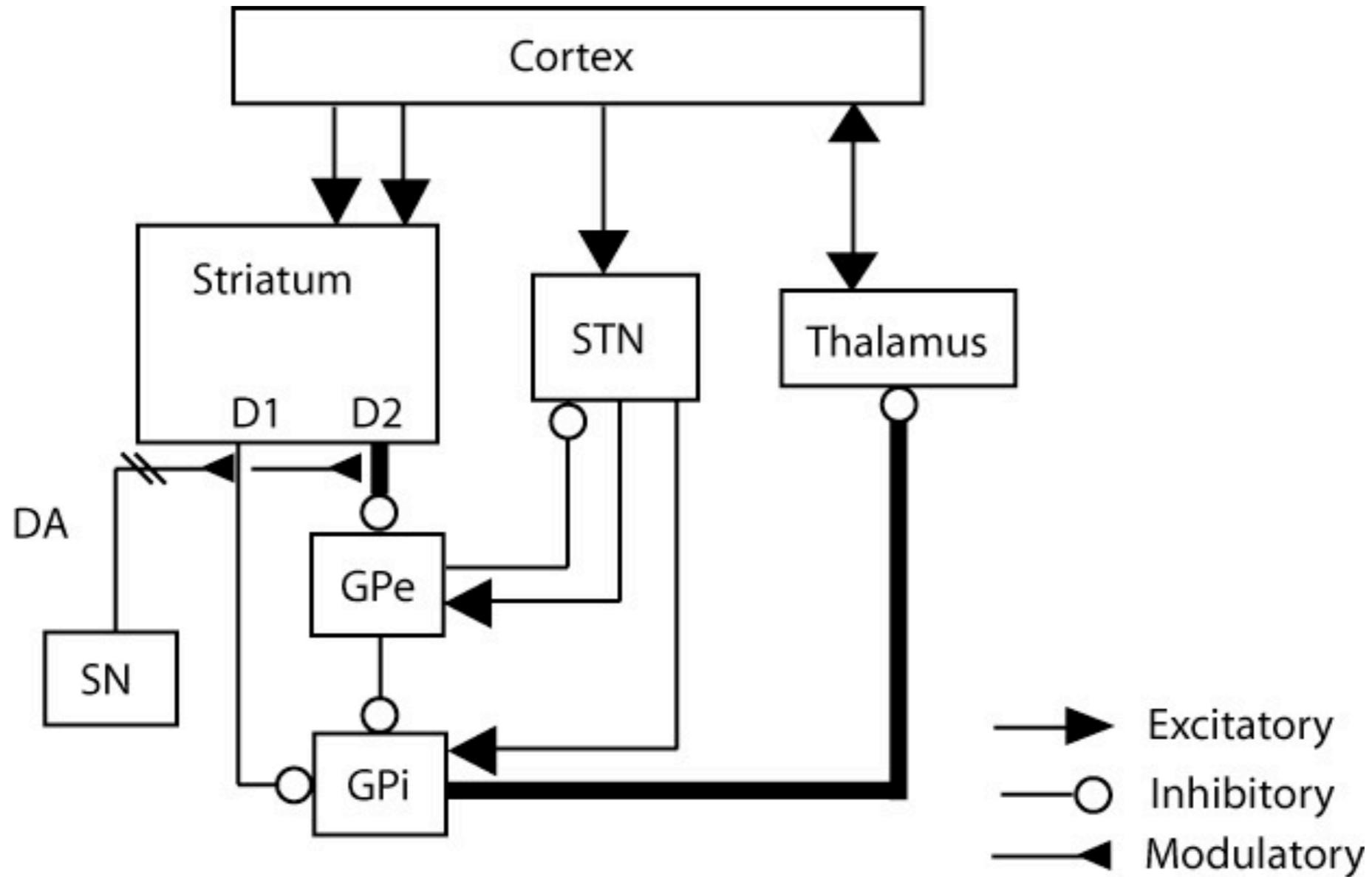
Basal Ganglia



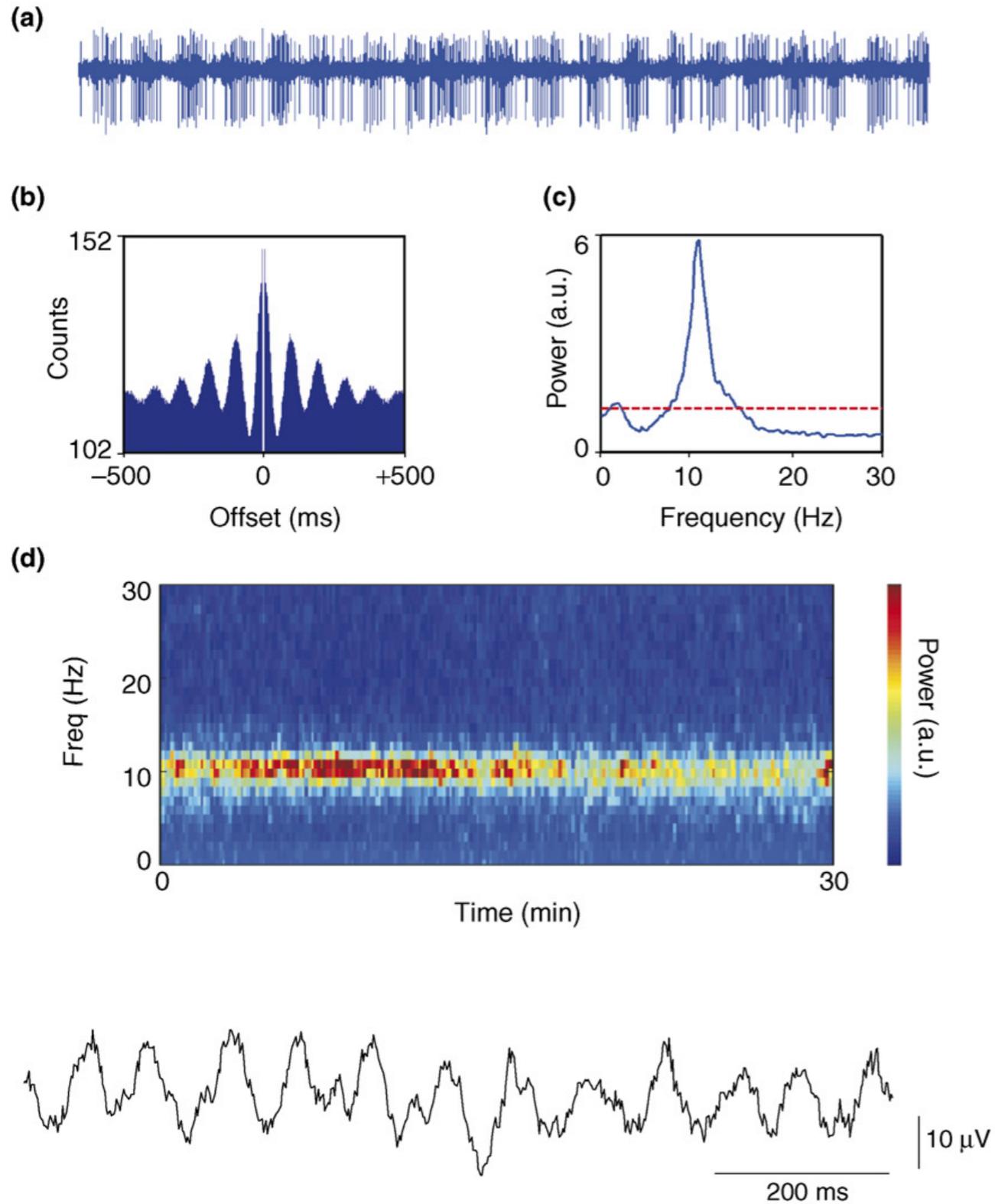
Basal Ganglia Circuitry



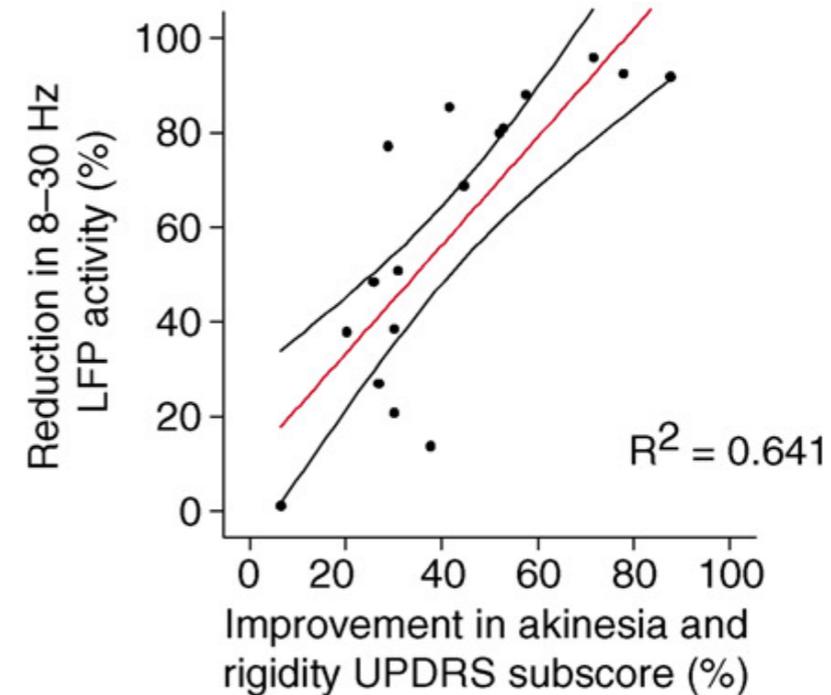
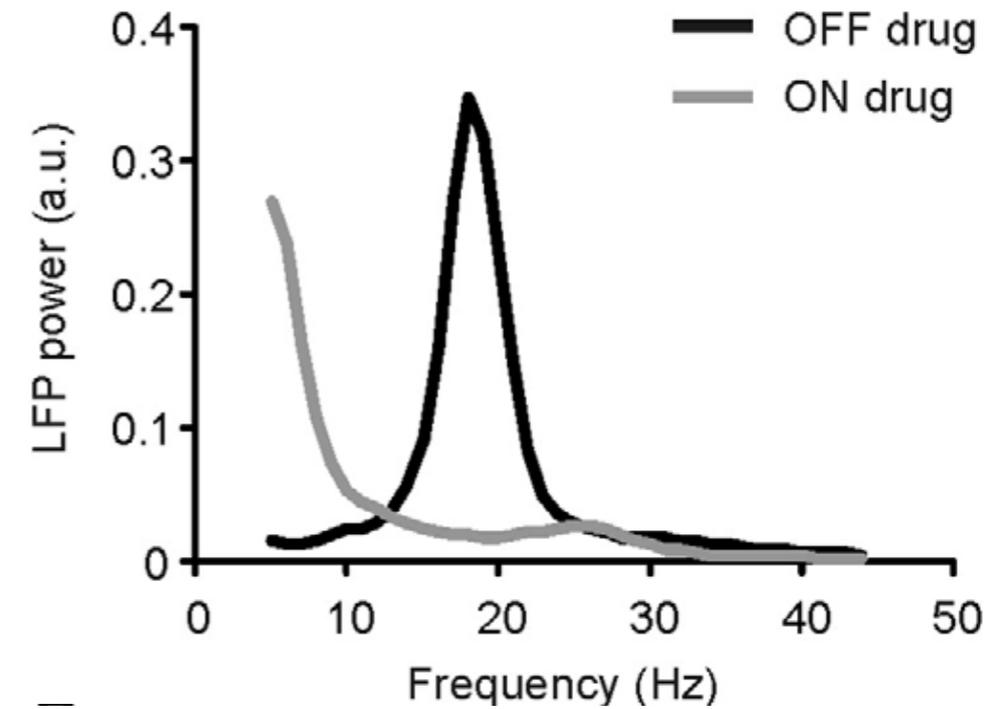
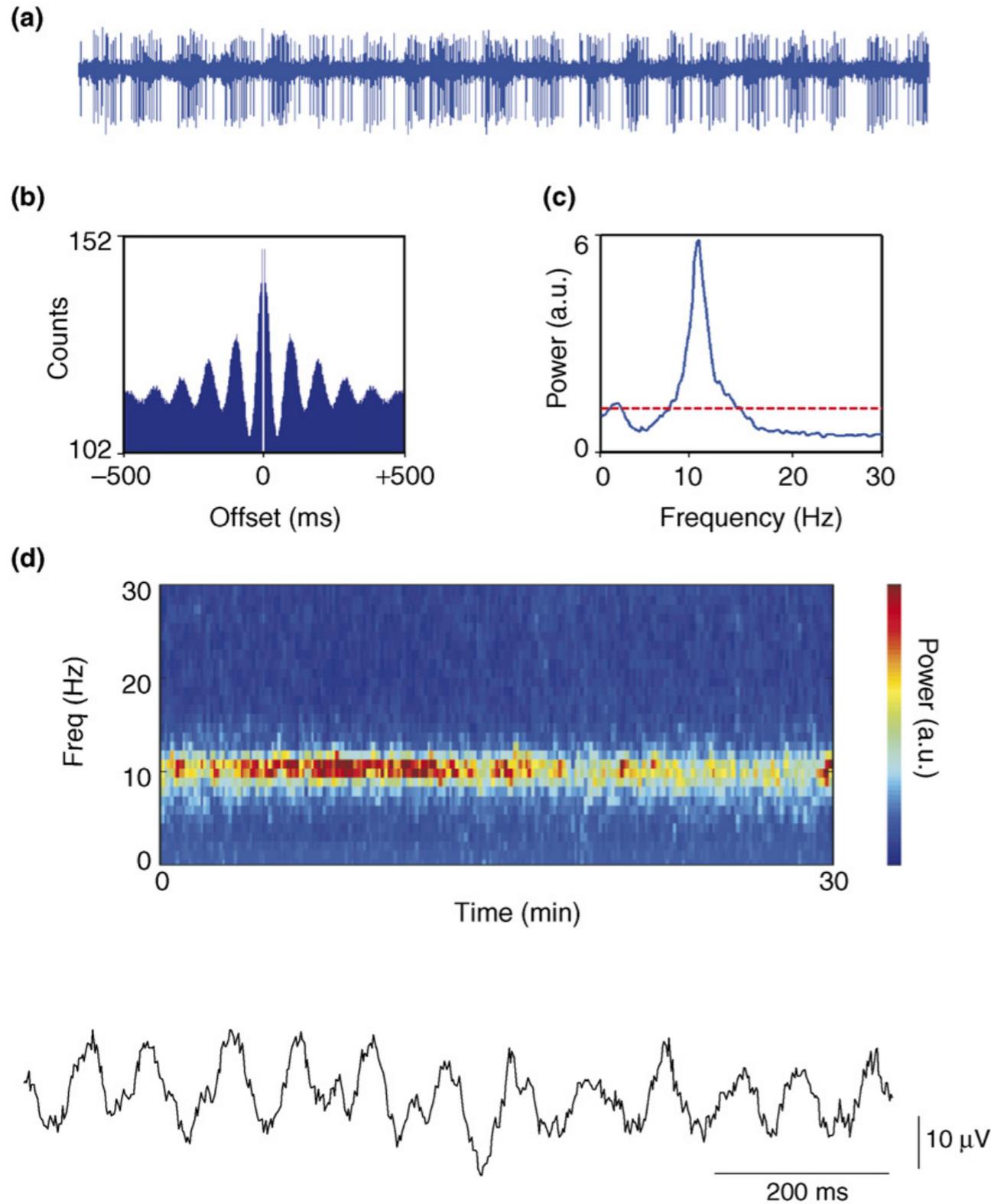
Parkinson's Disease



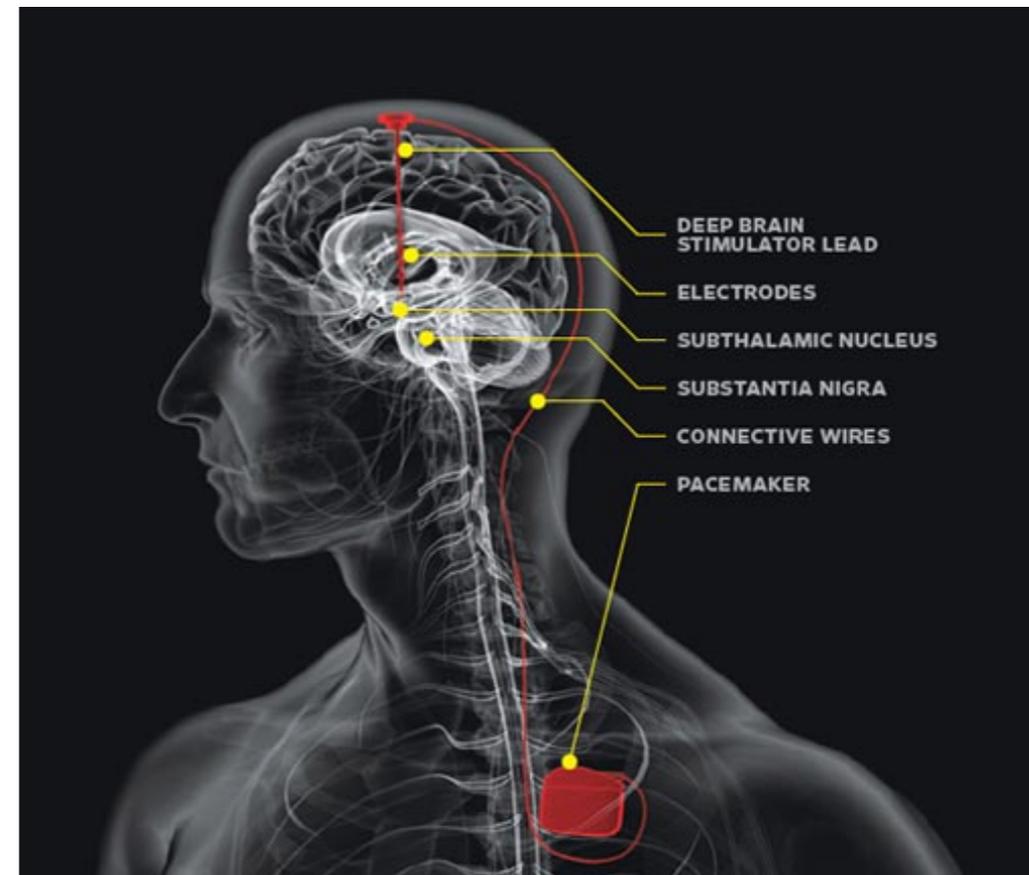
Parkinson's Disease



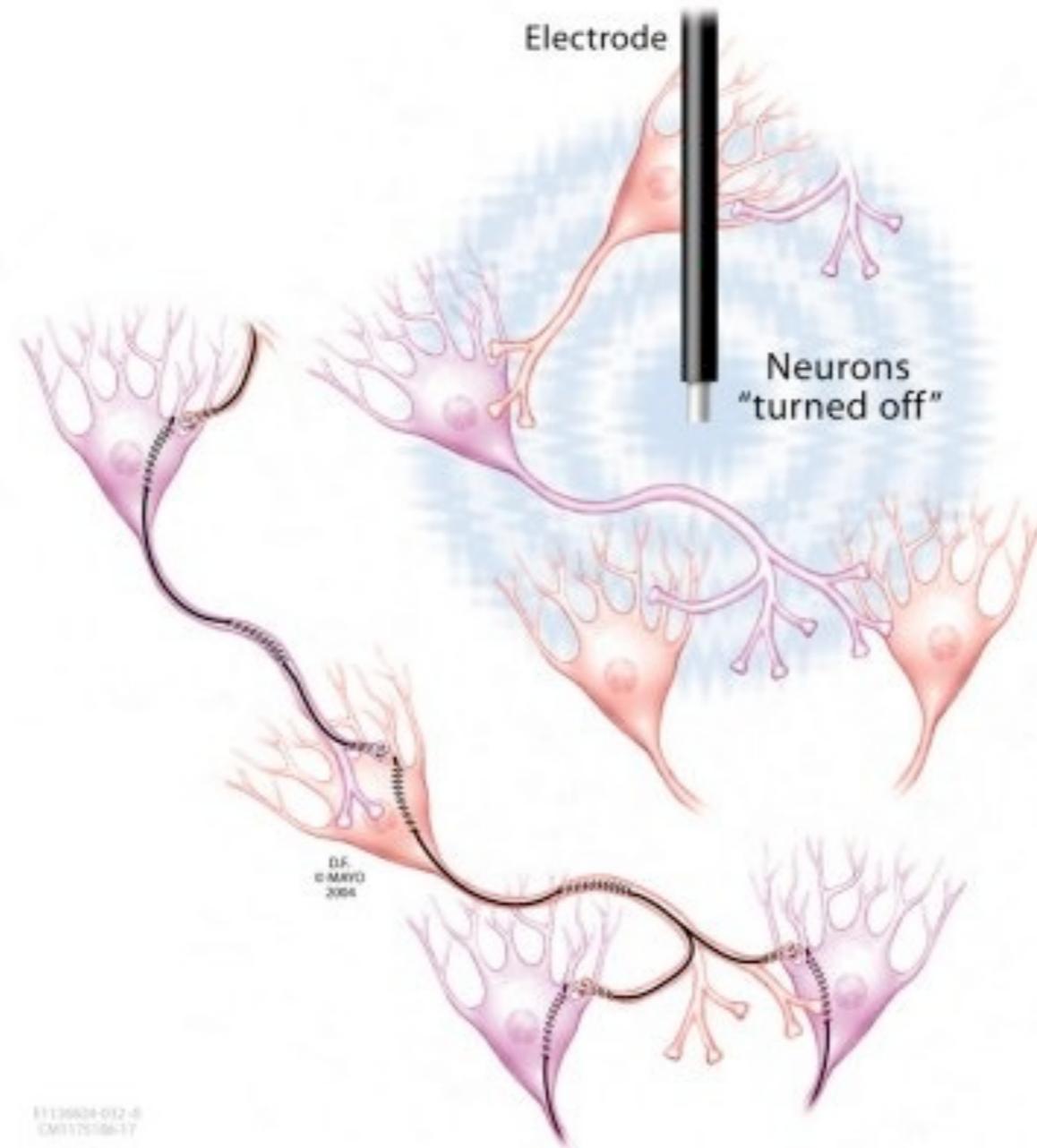
Parkinson's Disease



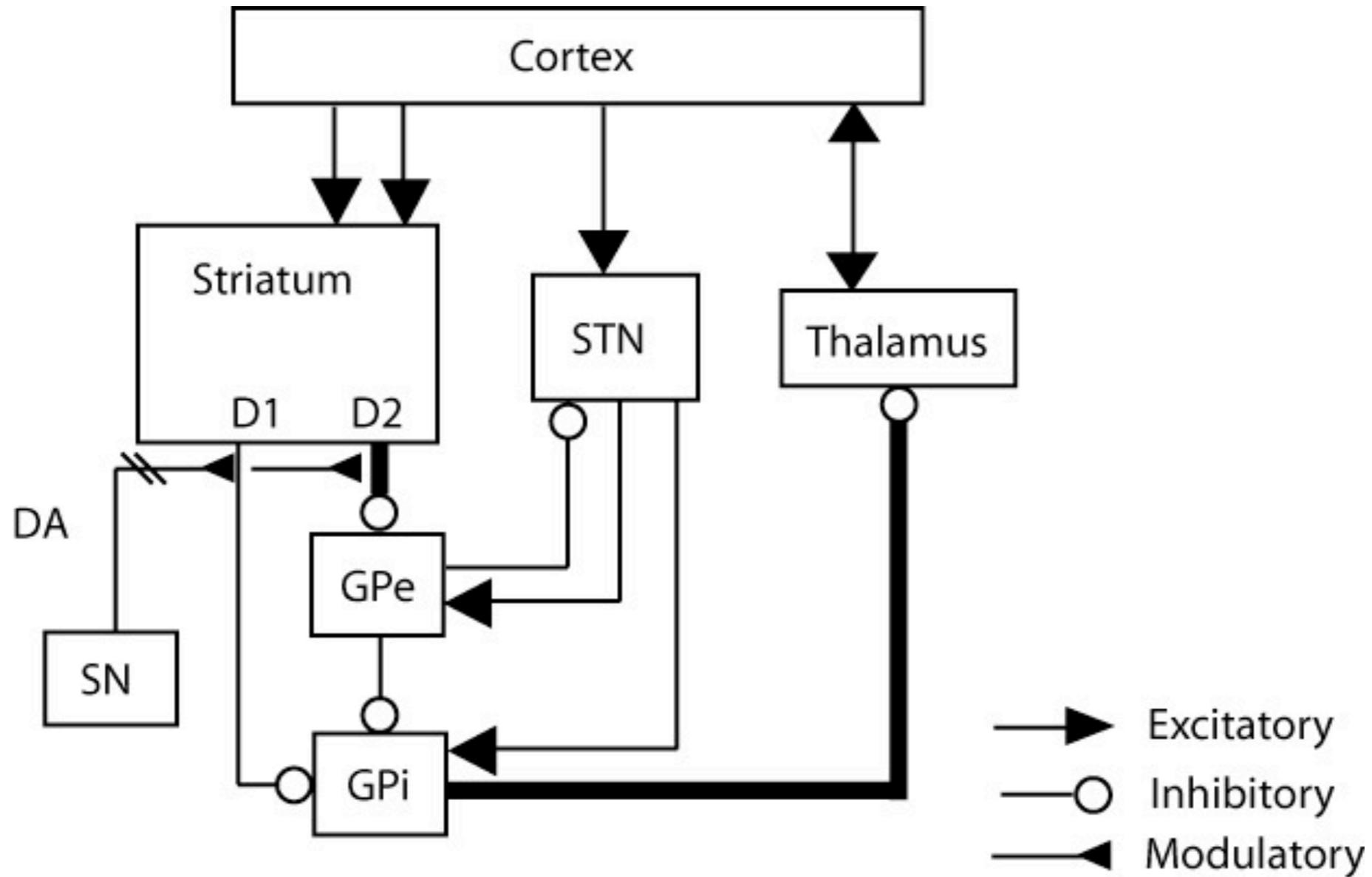
Deep Brain Stimulation



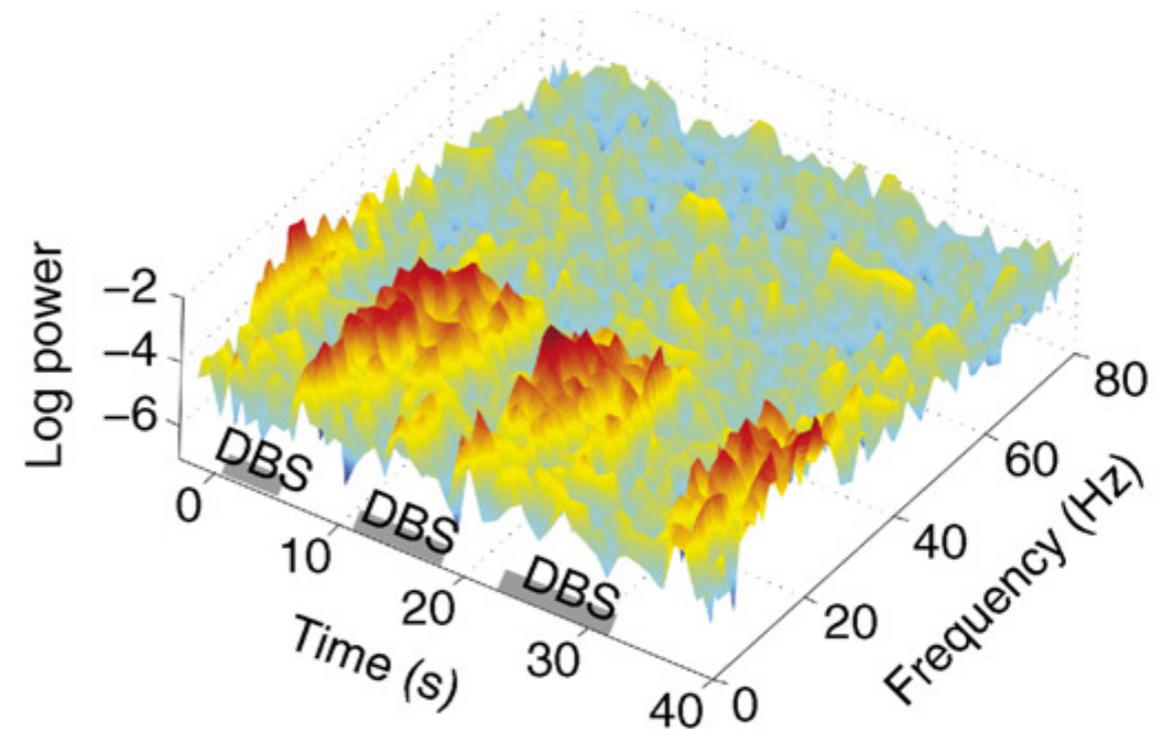
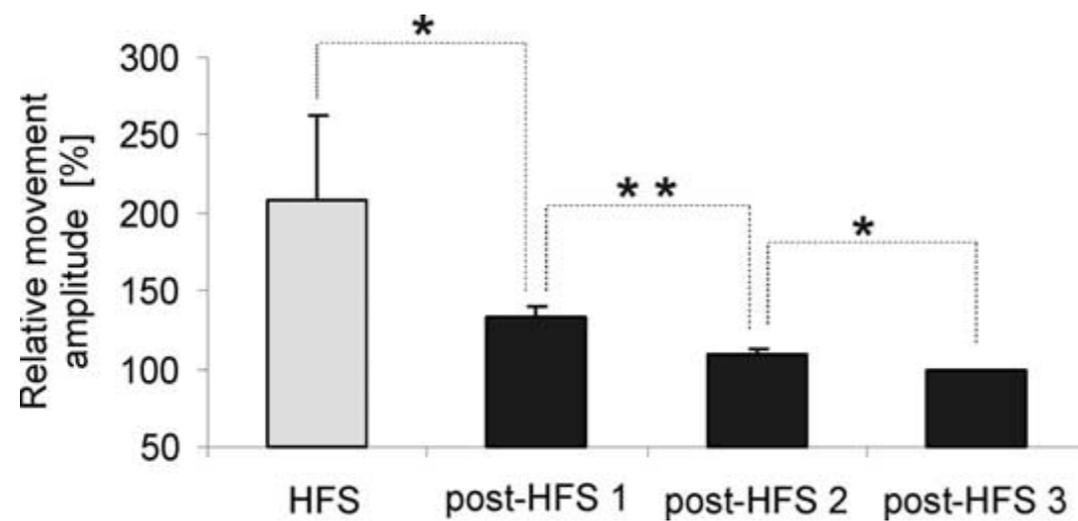
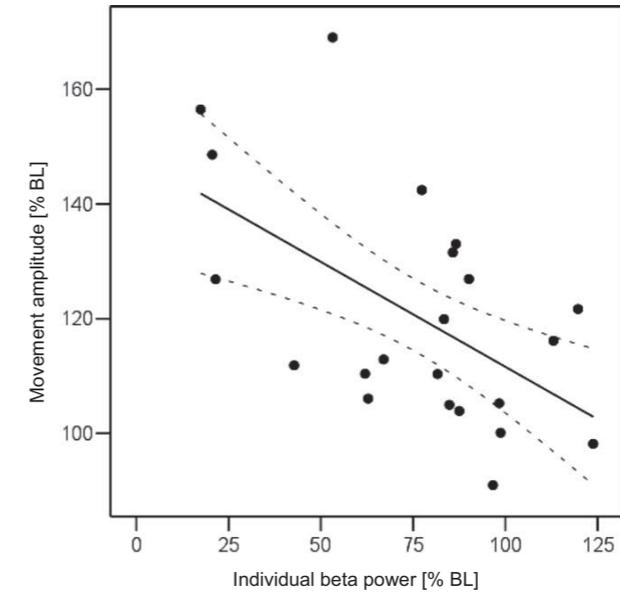
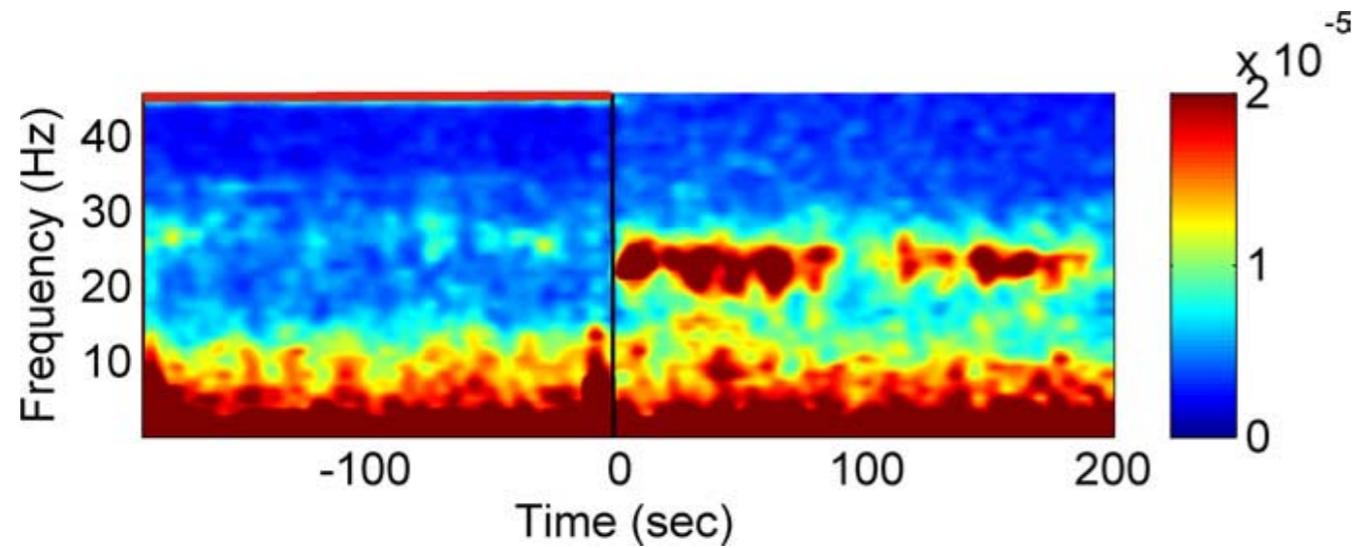
Electrode Ablation



Parkinson's Disease



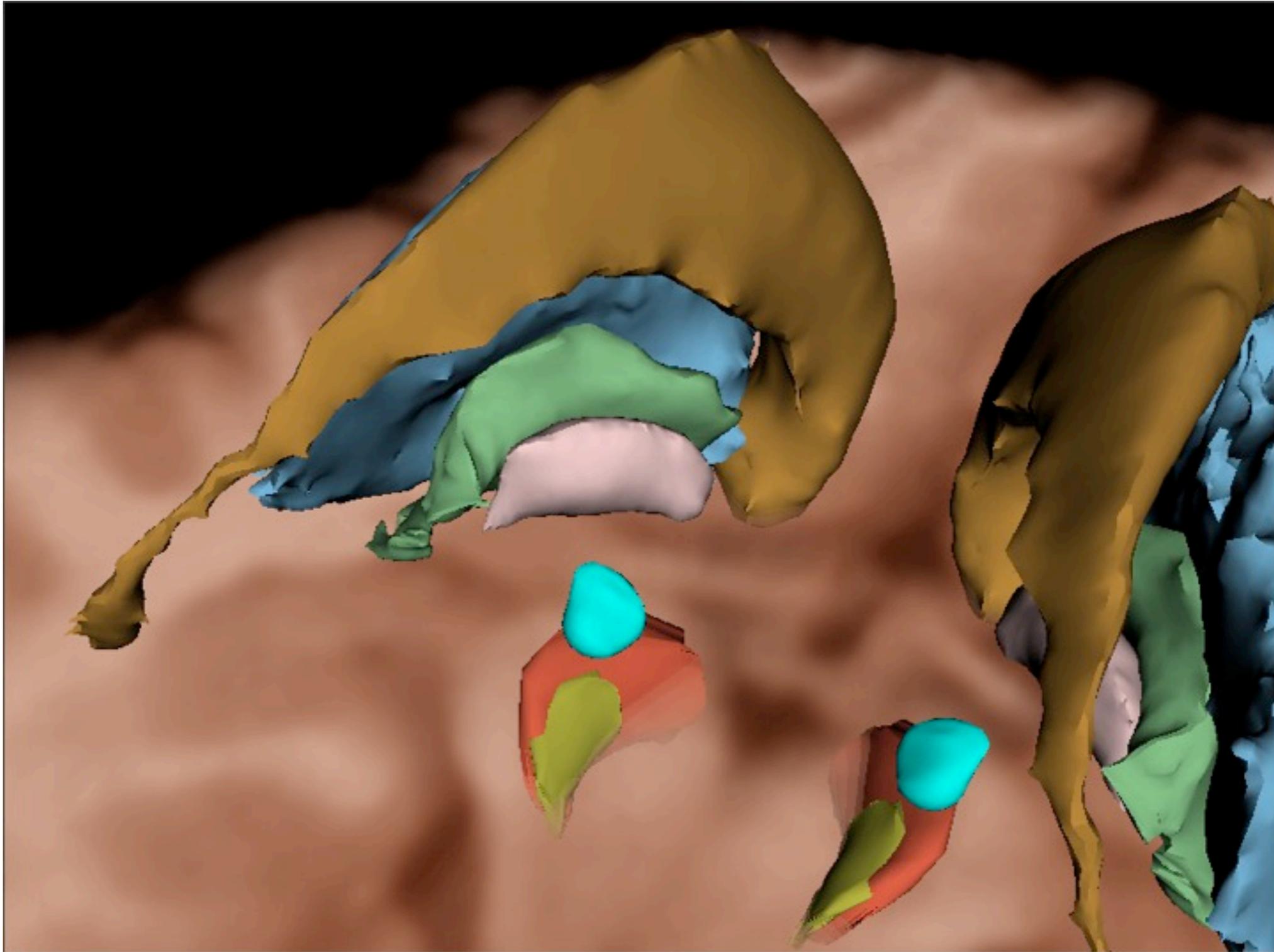
High frequency stimulation



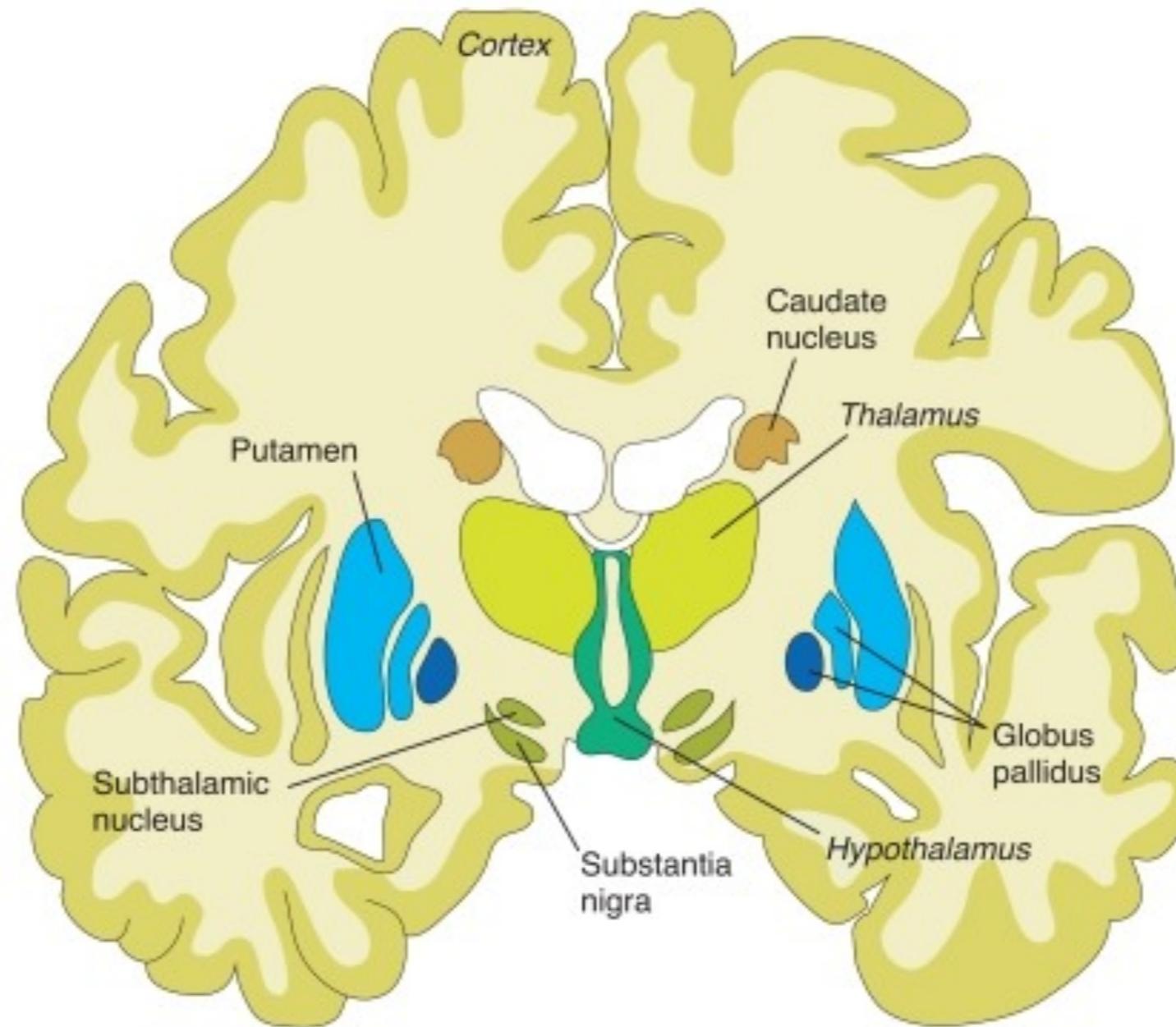
Kuhn, A et al (2008) High-frequency stimulation of the subthalamic nucleus suppresses oscillatory B activity in patients with Parkinson's disease in parallel with improved motor performance Journal of Neuroscience 28: 6165-6173

Hammond, C et al (2007) Pathological synchronization in Parkinson's disease: networks, models, and treatments Trends in Neurosciences 30: 357-364

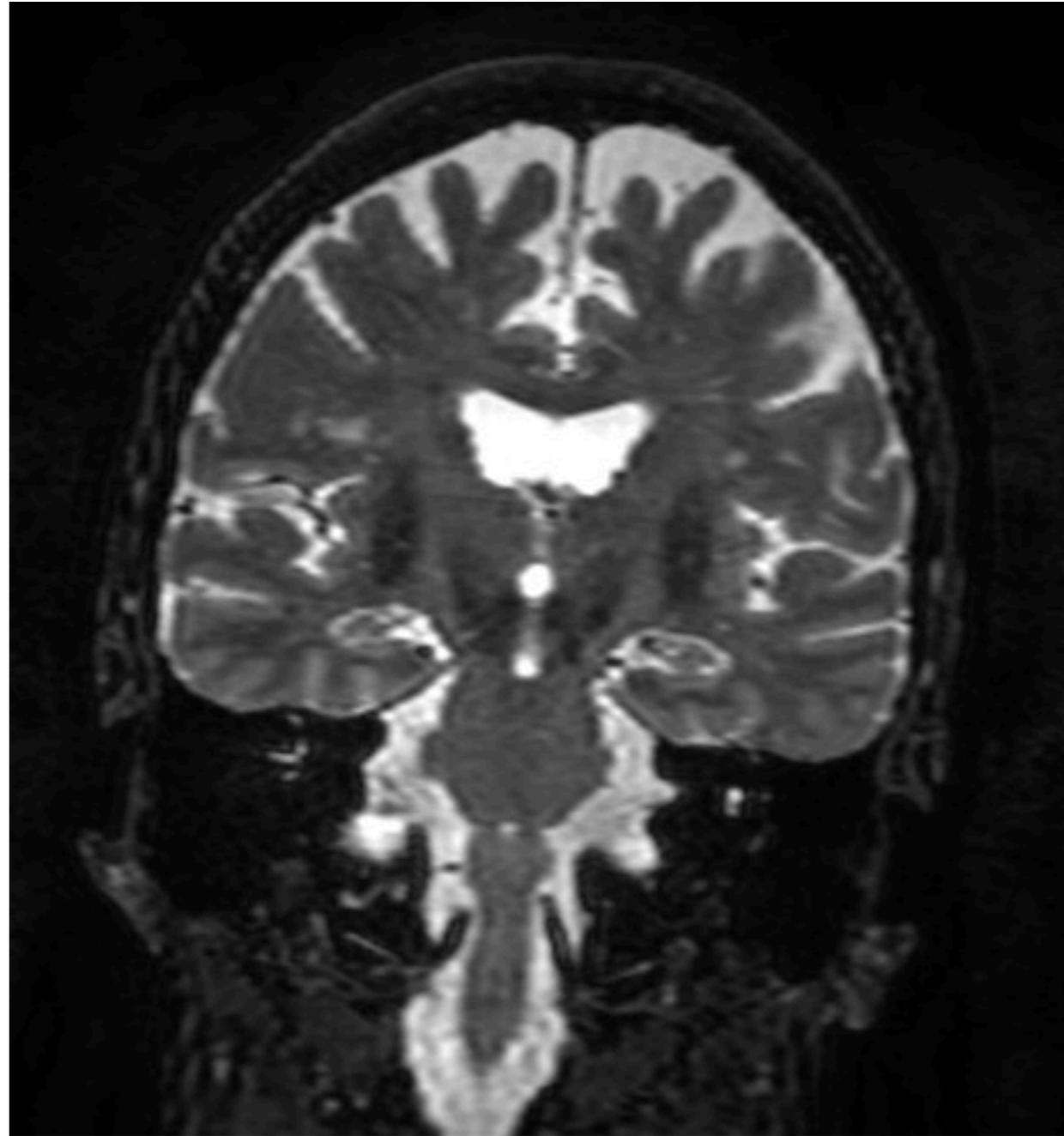
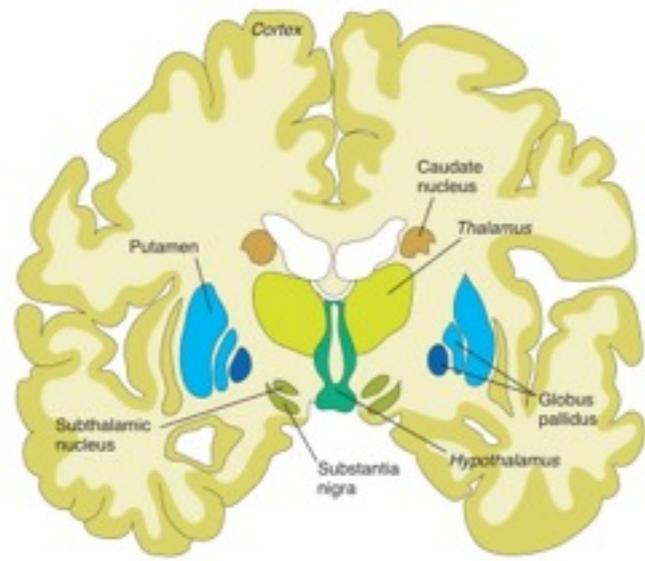
Basal Ganglia



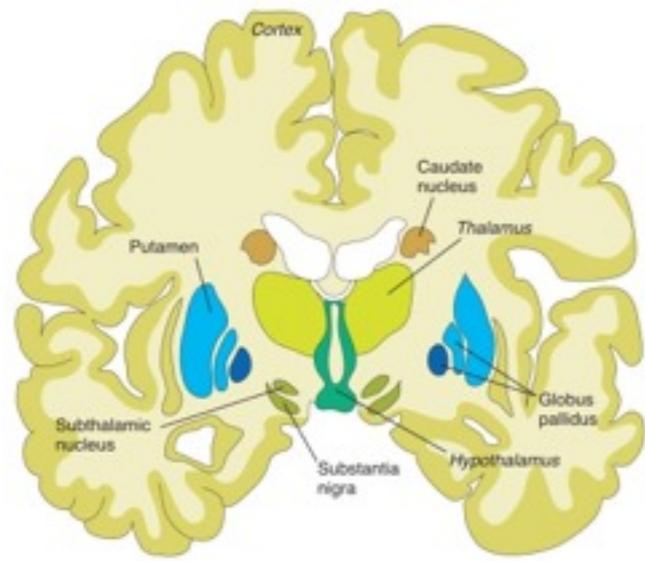
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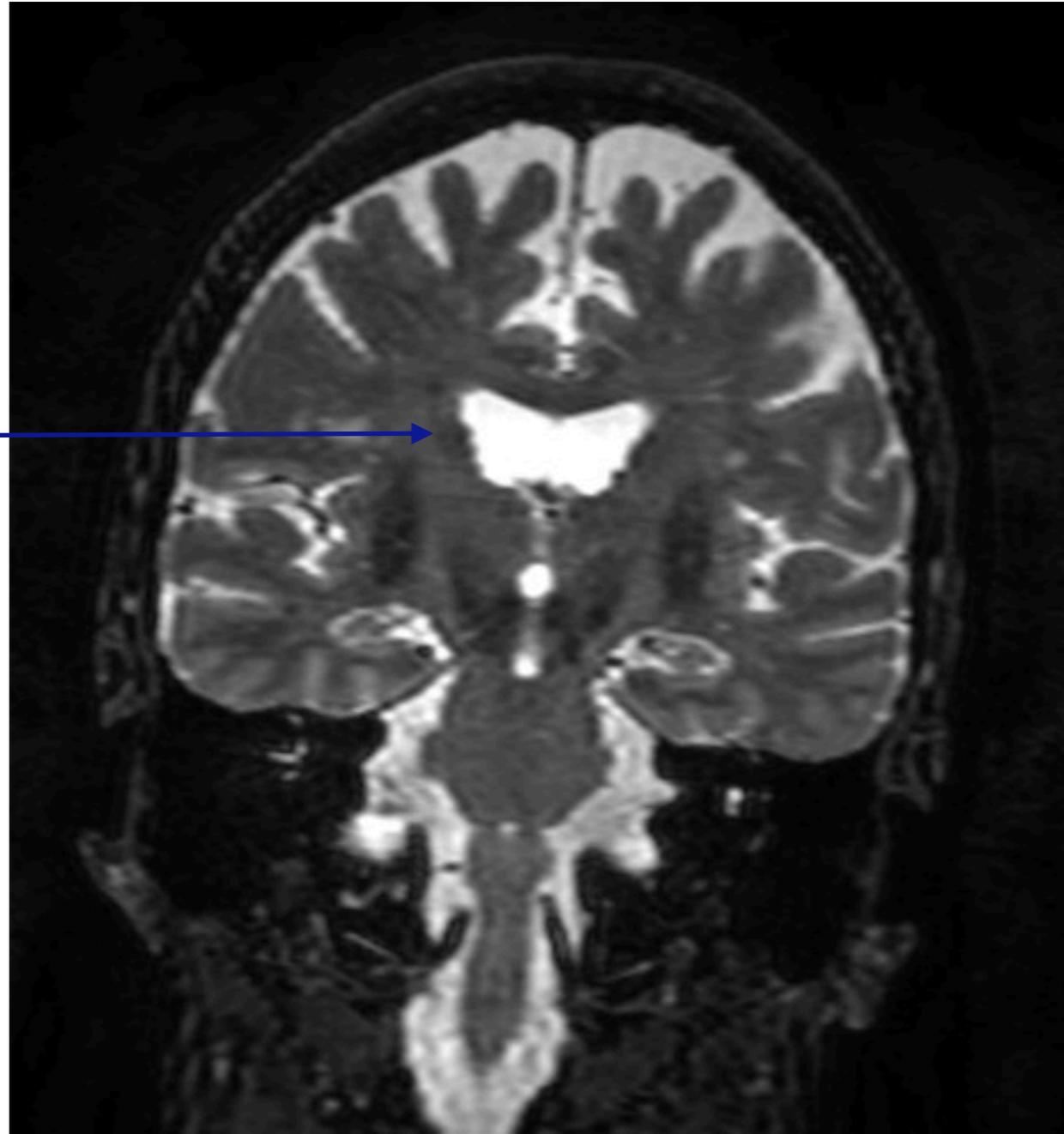
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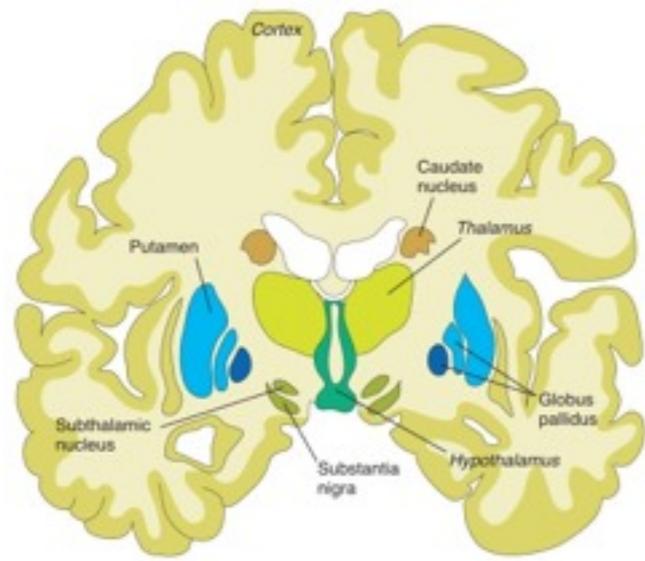
Basal Ganglia



Caudate

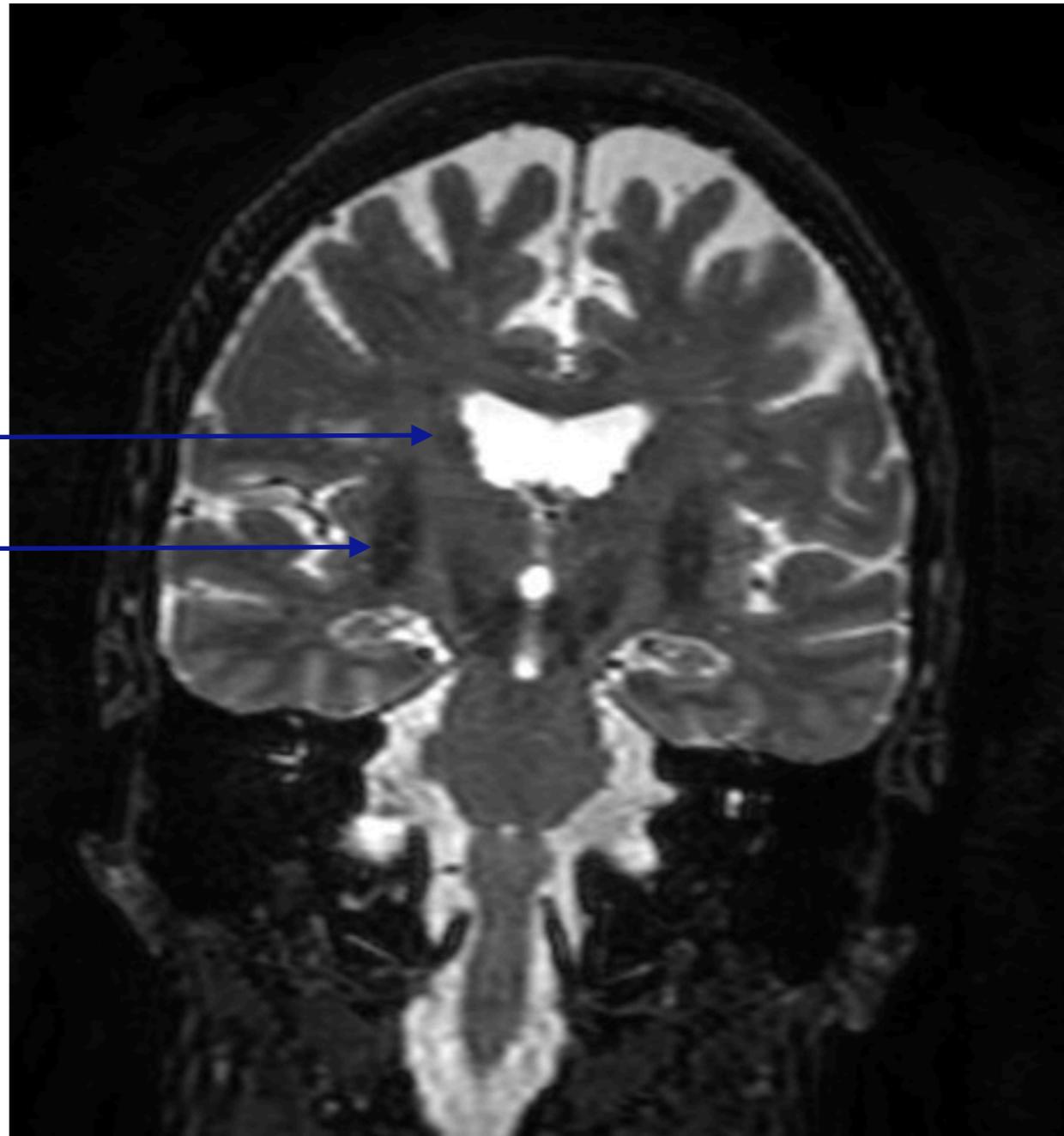


Basal Ganglia

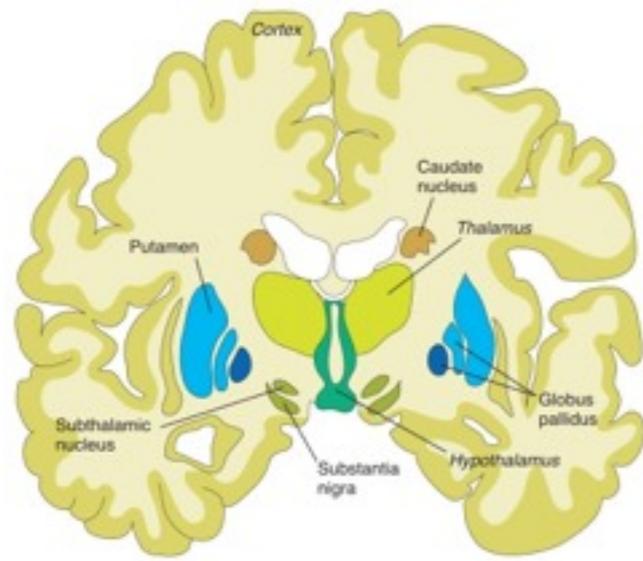


Caudate

Putamen, GP



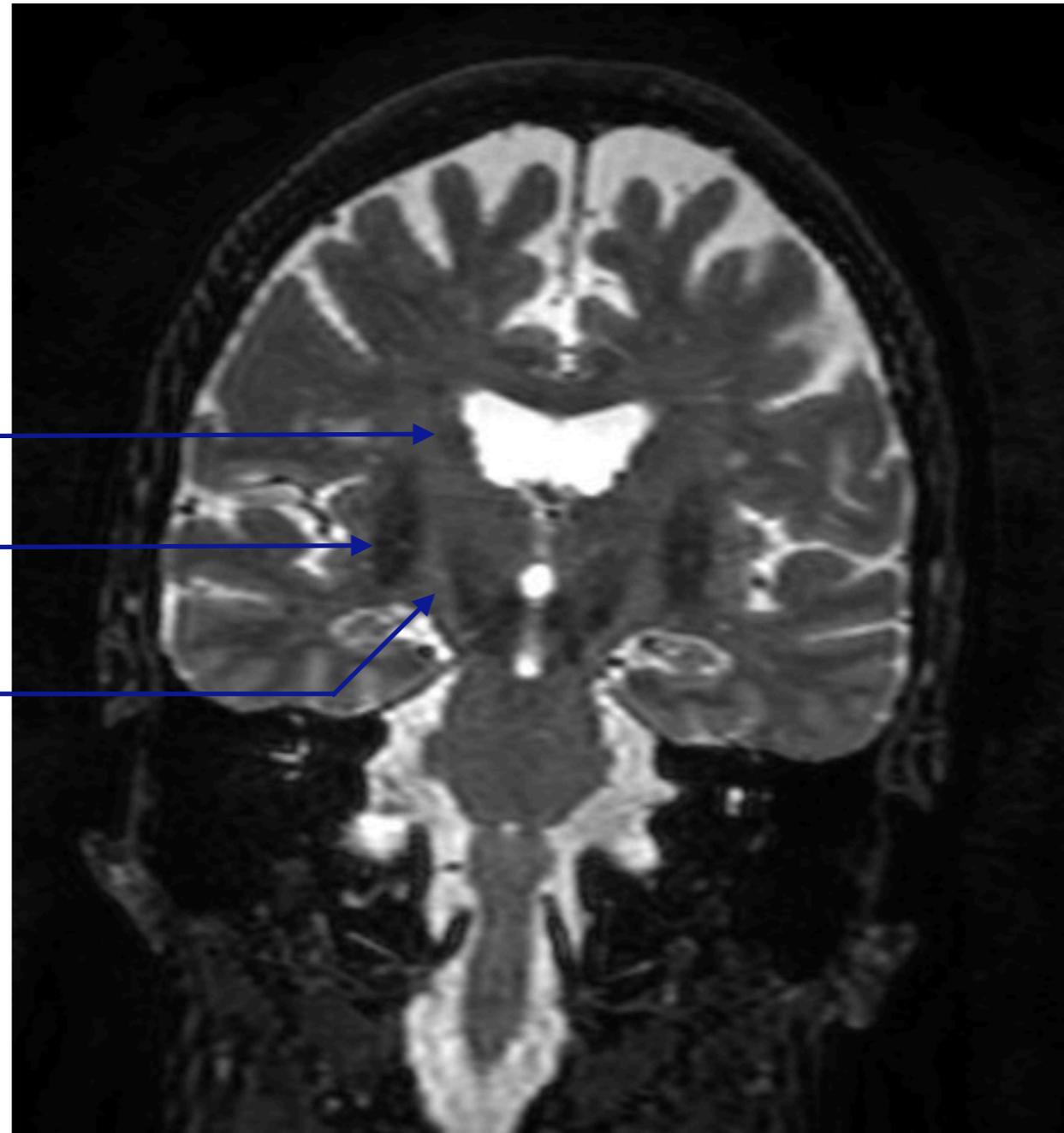
Basal Ganglia



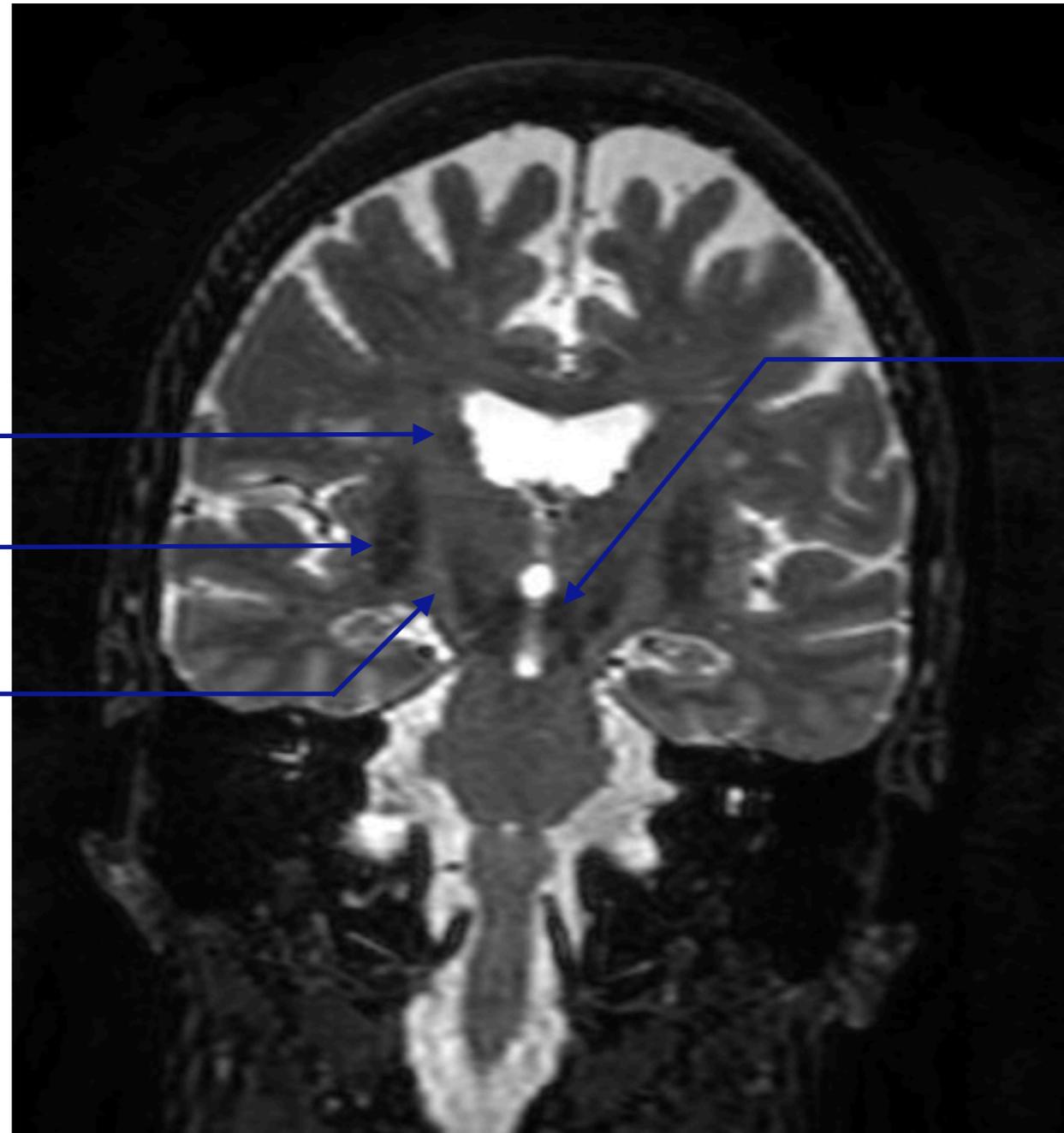
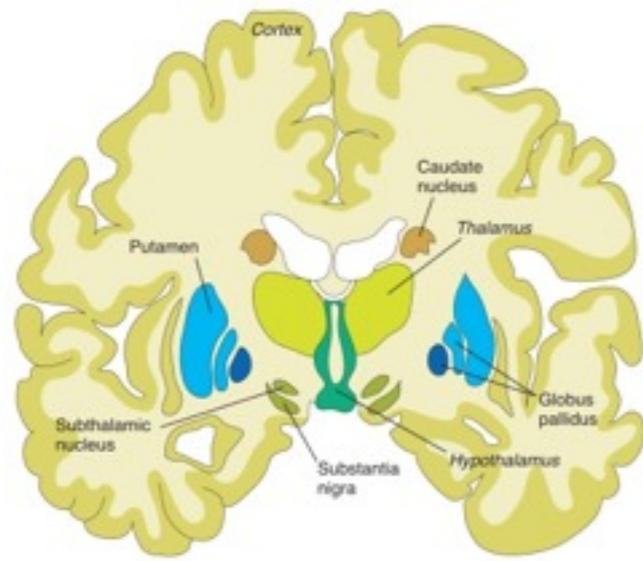
Caudate

Putamen, GP

Internal
Capsule



Basal Ganglia



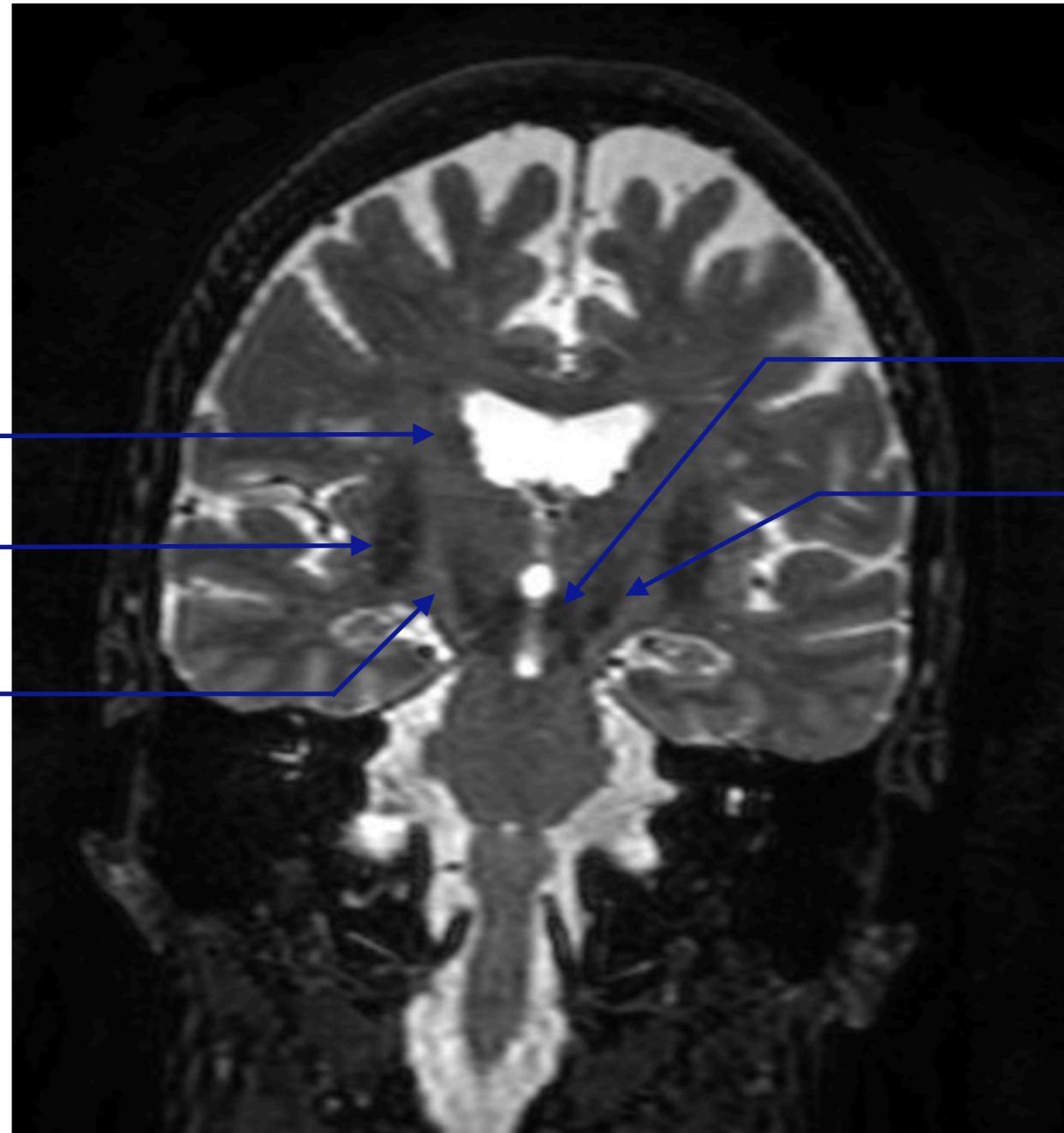
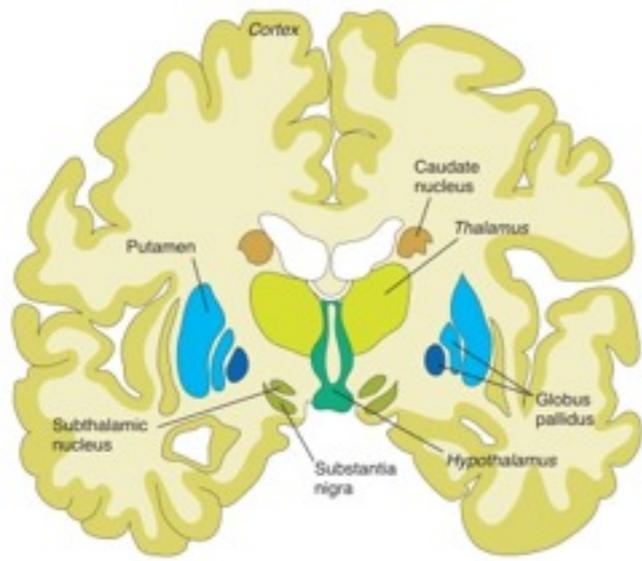
Caudate

Putamen, GP

Internal
Capsule

Red Nucleus

Basal Ganglia



Caudate

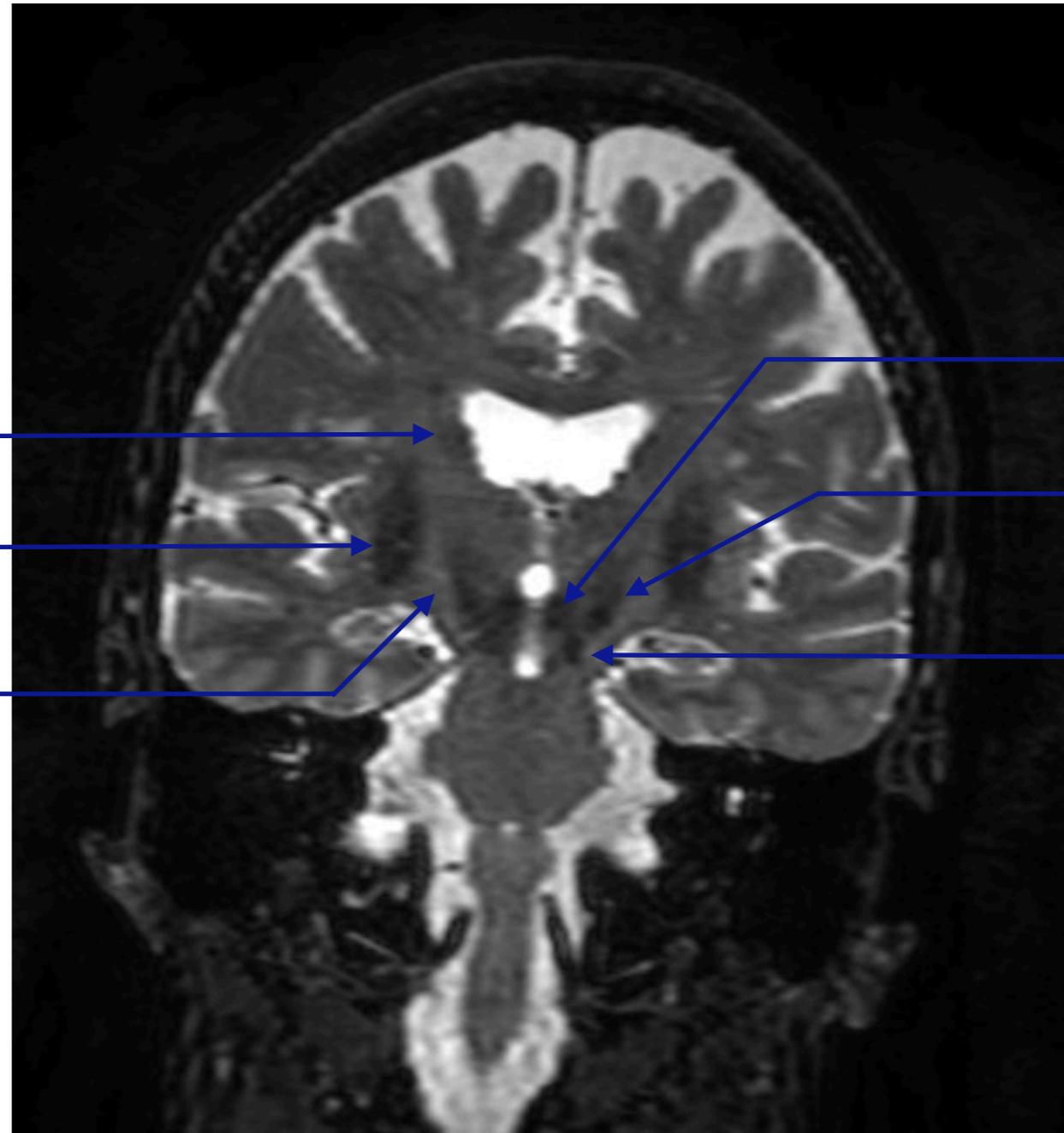
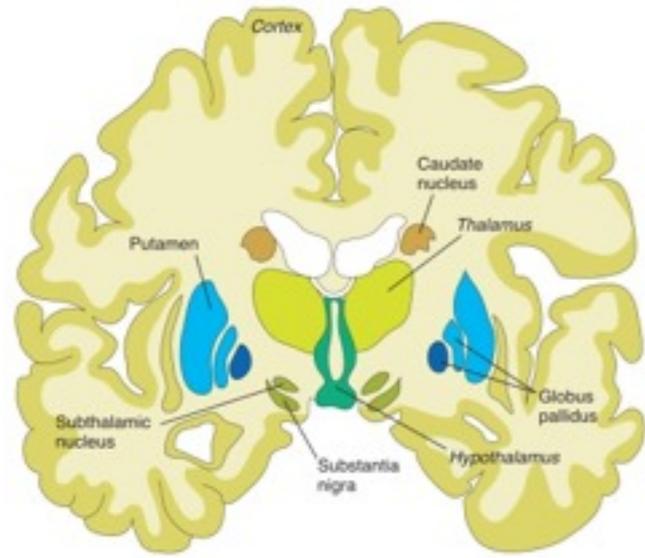
Putamen, GP

Internal
Capsule

Red Nucleus

STN

Basal Ganglia



Caudate

Putamen, GP

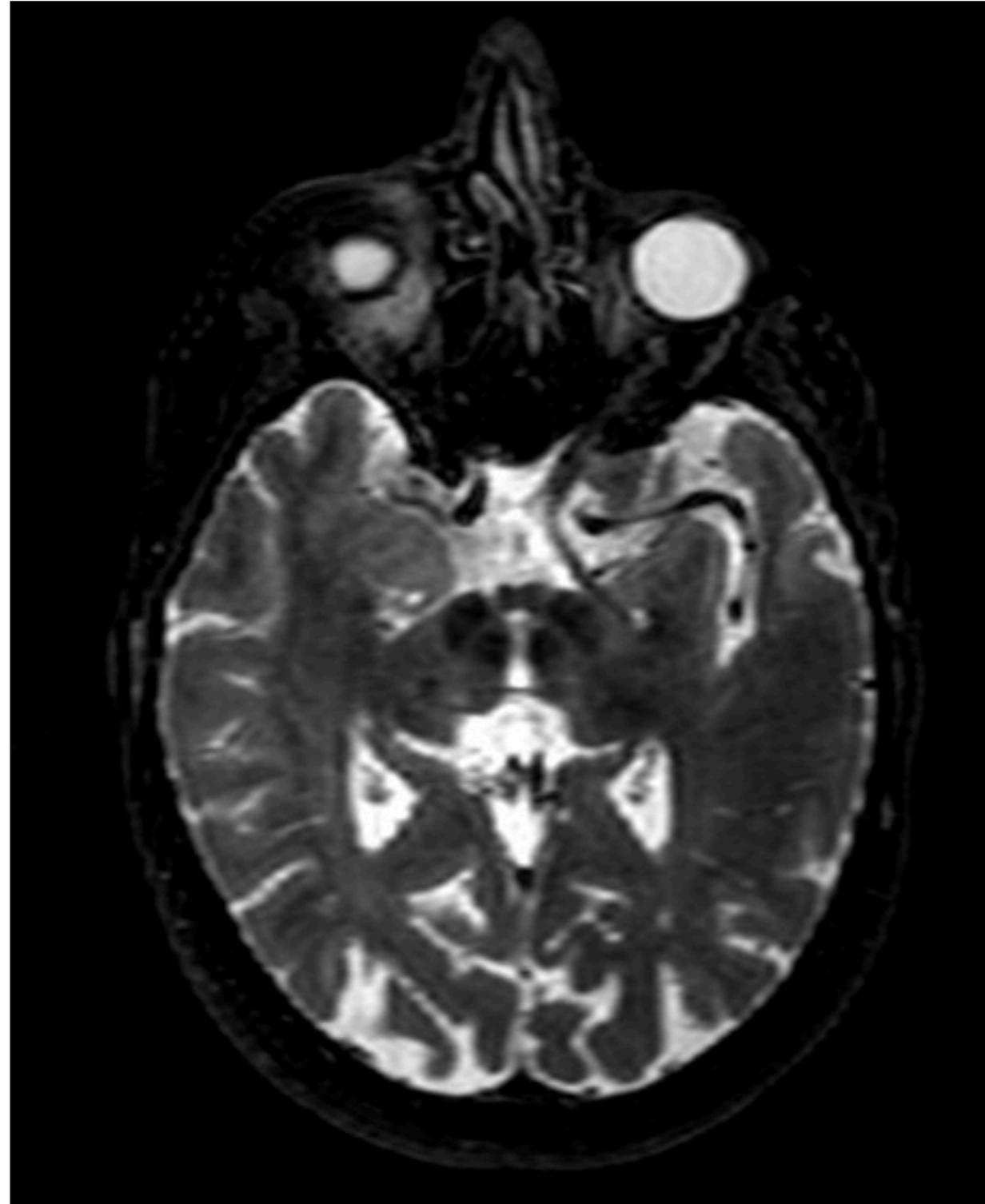
Internal
Capsule

Red Nucleus

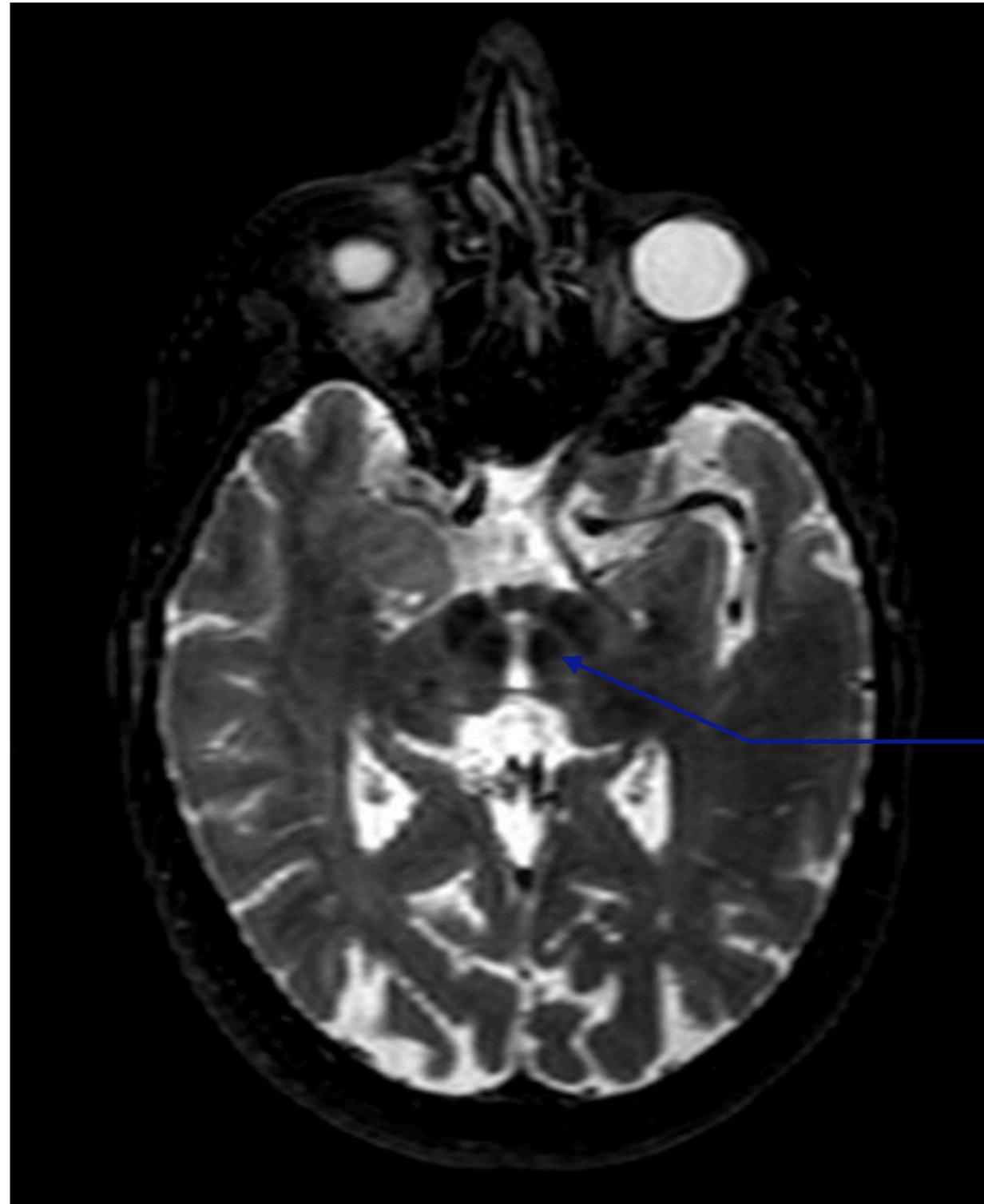
STN

Substantia
Nigra

Basal Ganglia

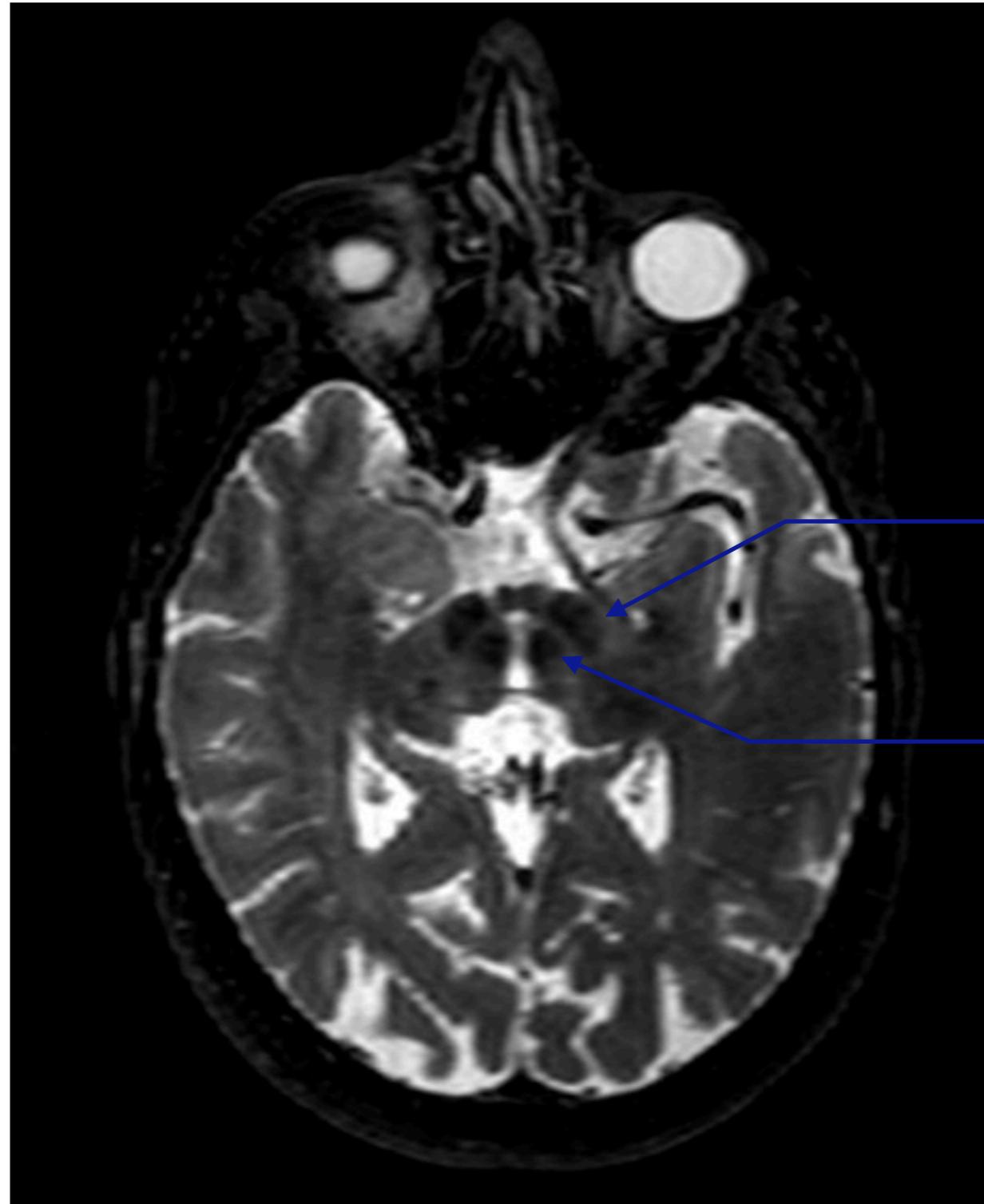


Basal Ganglia



Red Nucleus

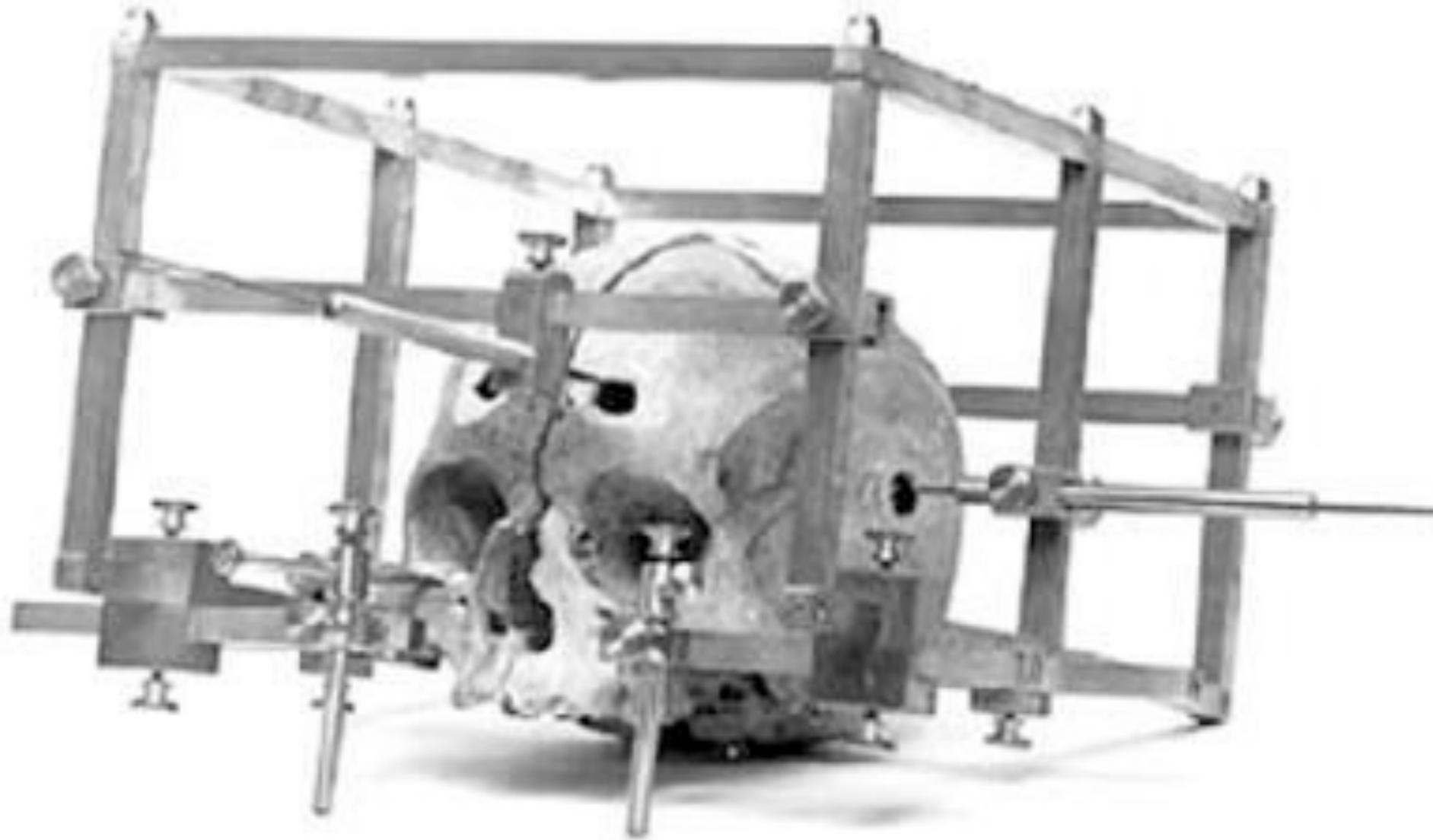
Basal Ganglia



STN

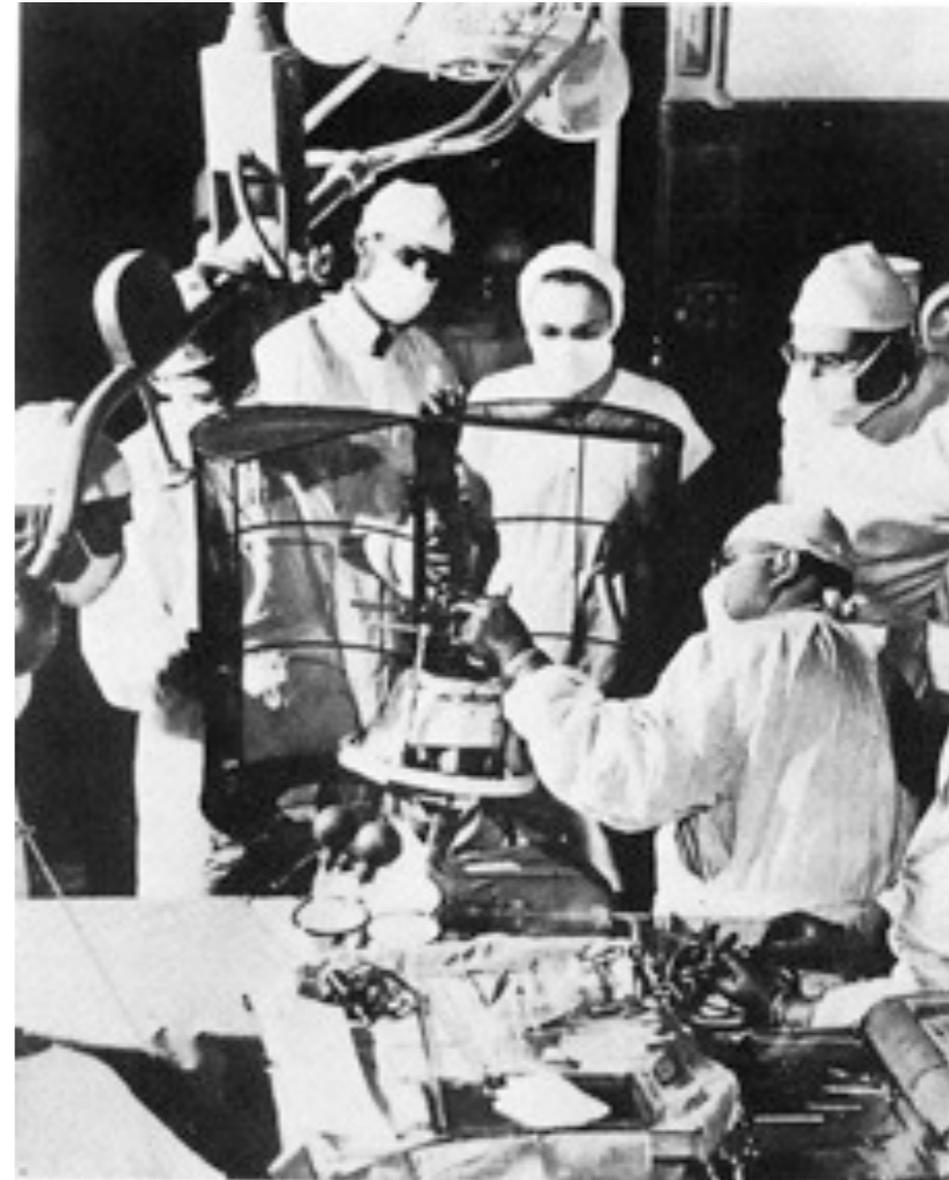
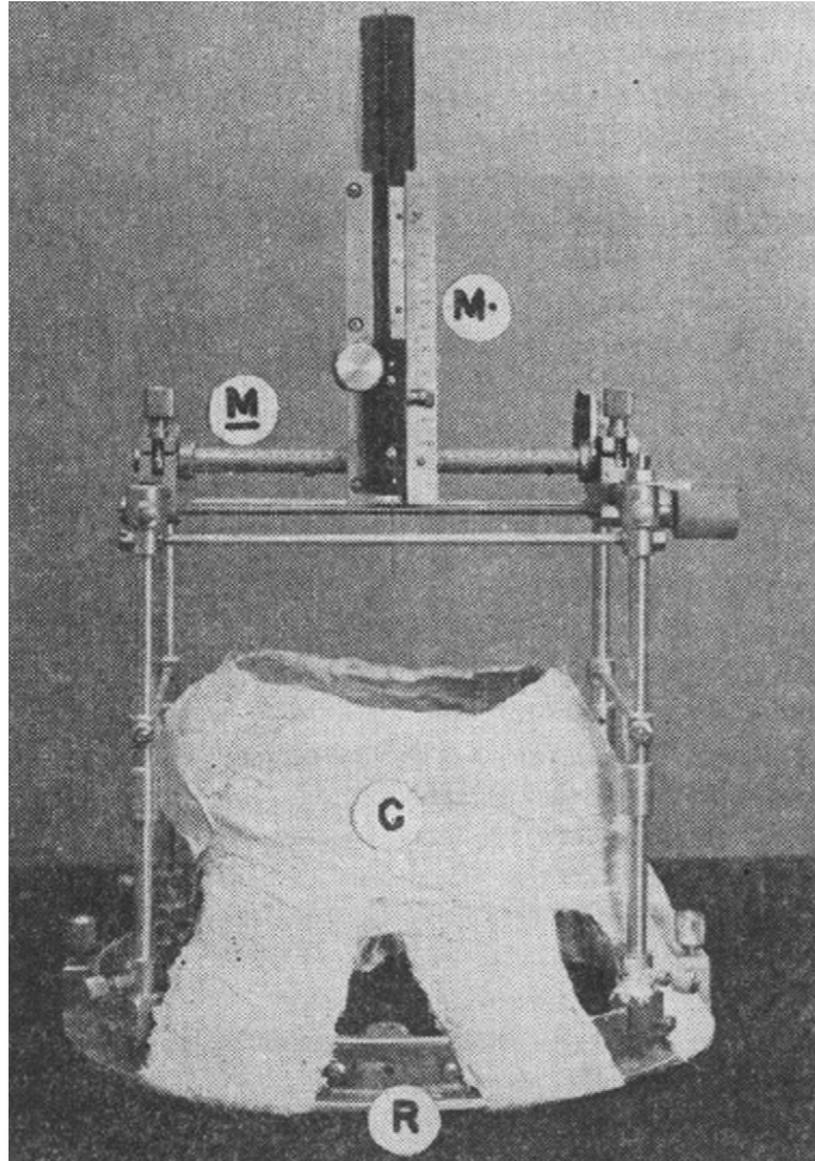
Red Nucleus

Stereotactic Surgery



Victor Horsley & Robert Henry Clarke
1908

Stereotactic Surgery

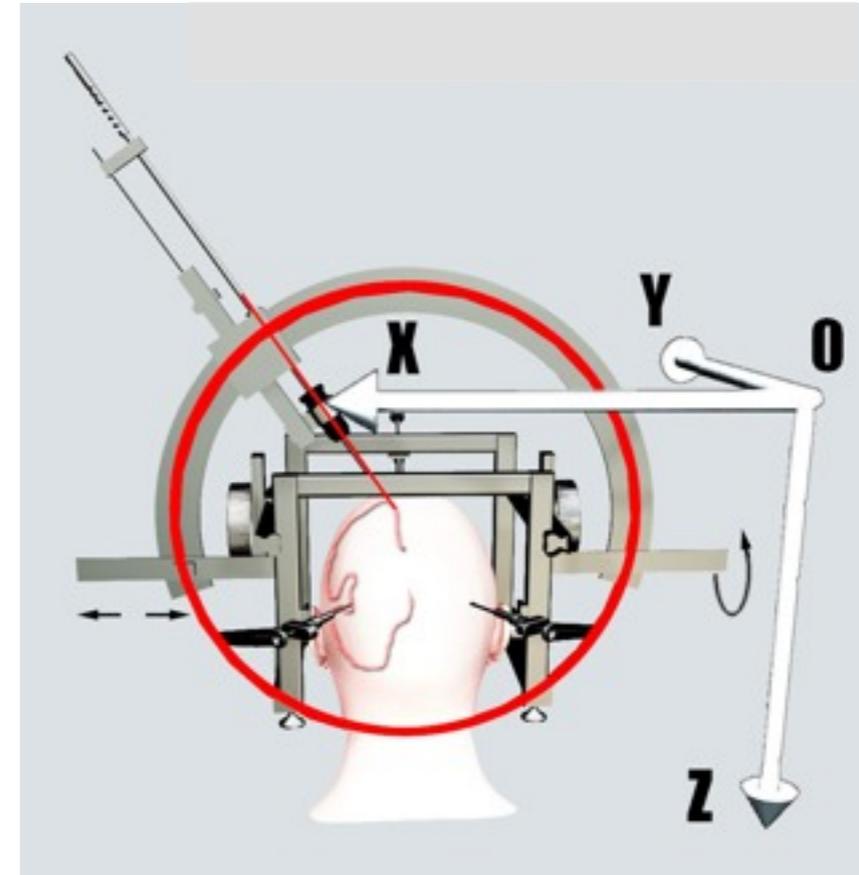


Ernest Spiegel & Henry Wycis
1947

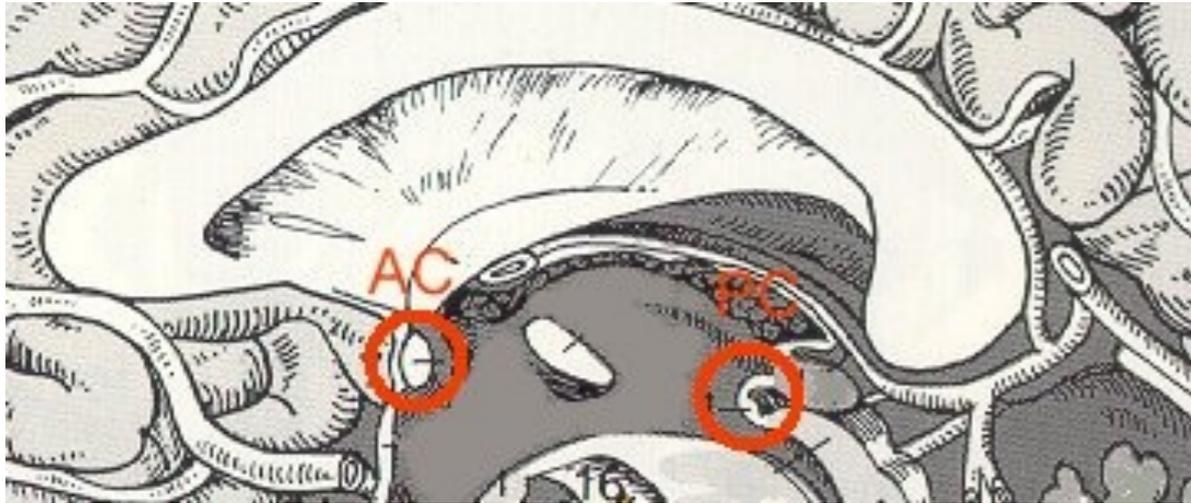
Stereotactic Neurosurgery



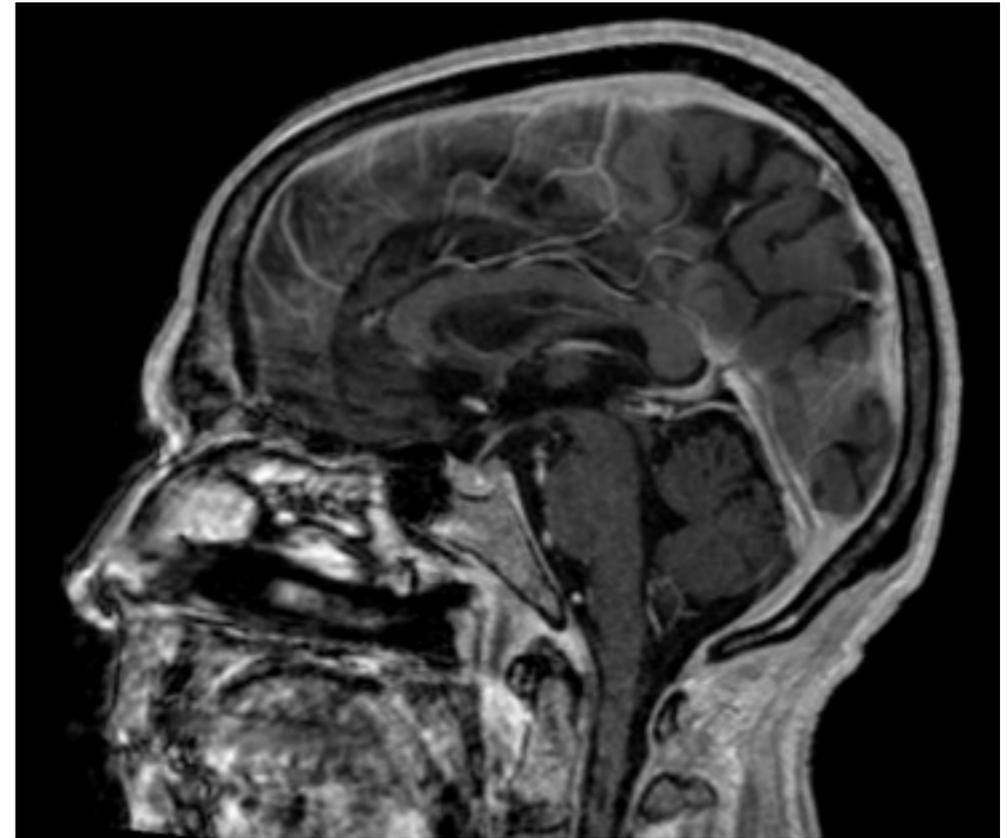
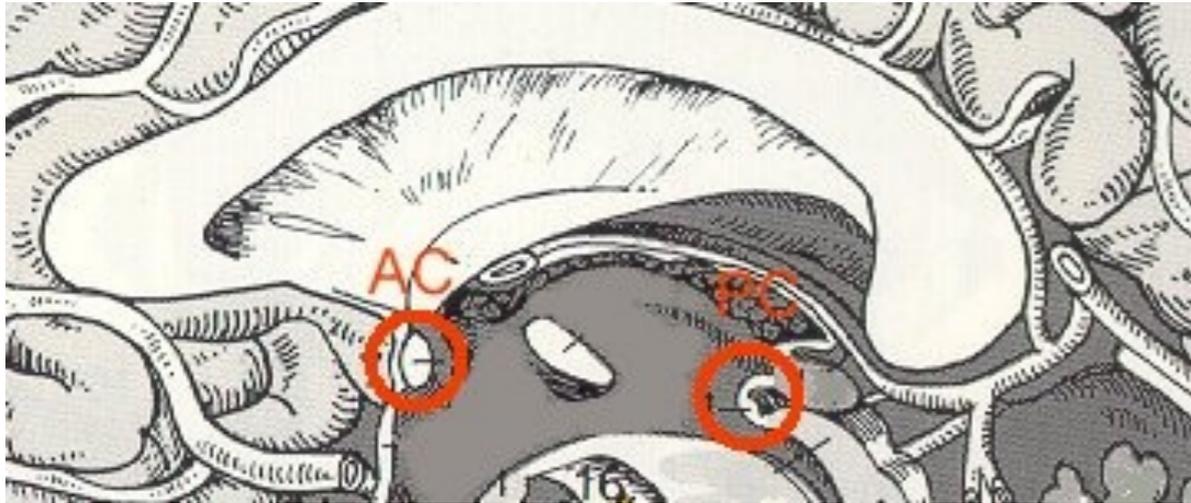
Stereotactic Neurosurgery



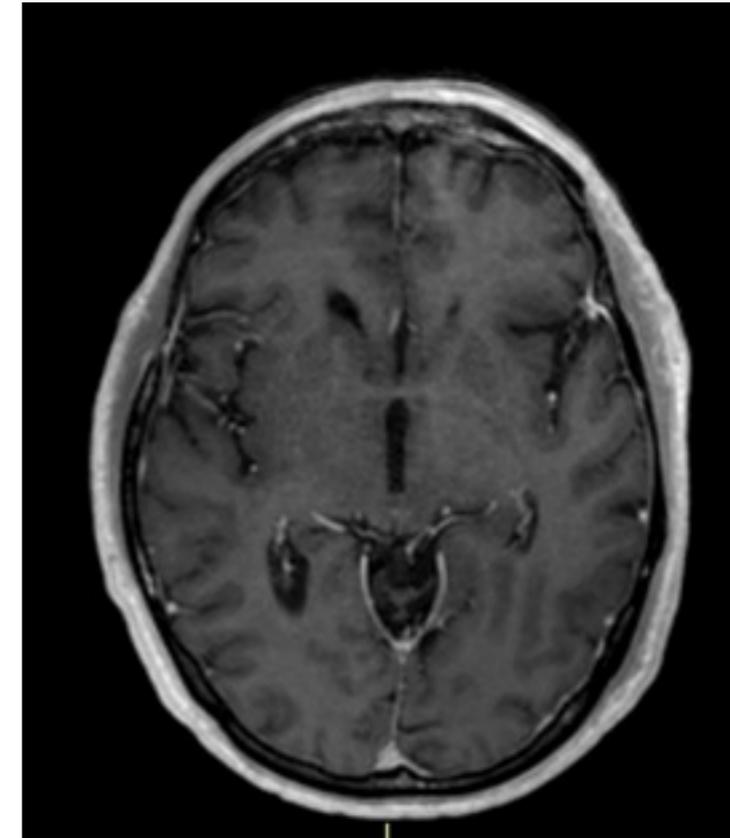
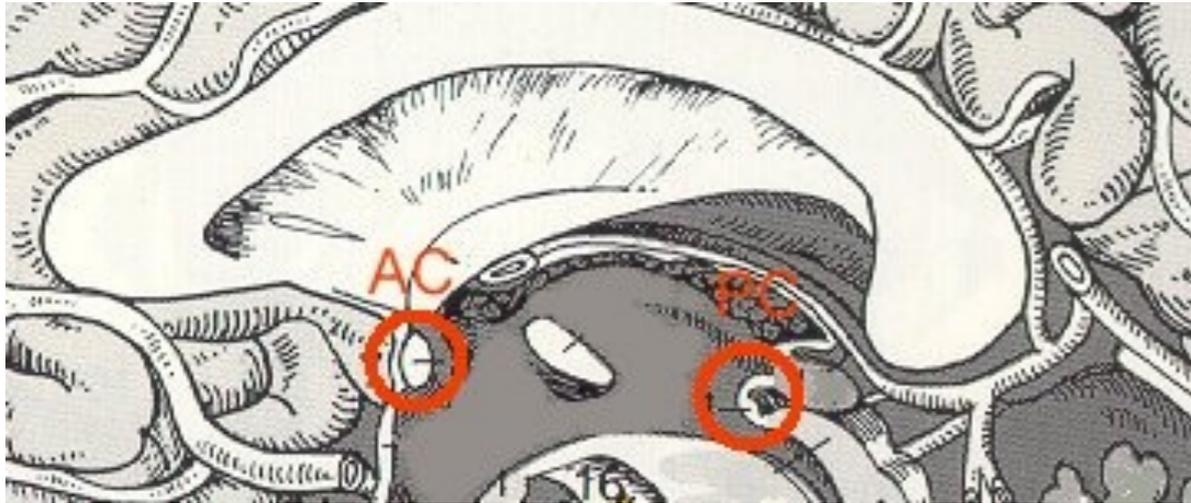
Anterior Commissure-Posterior Commissure



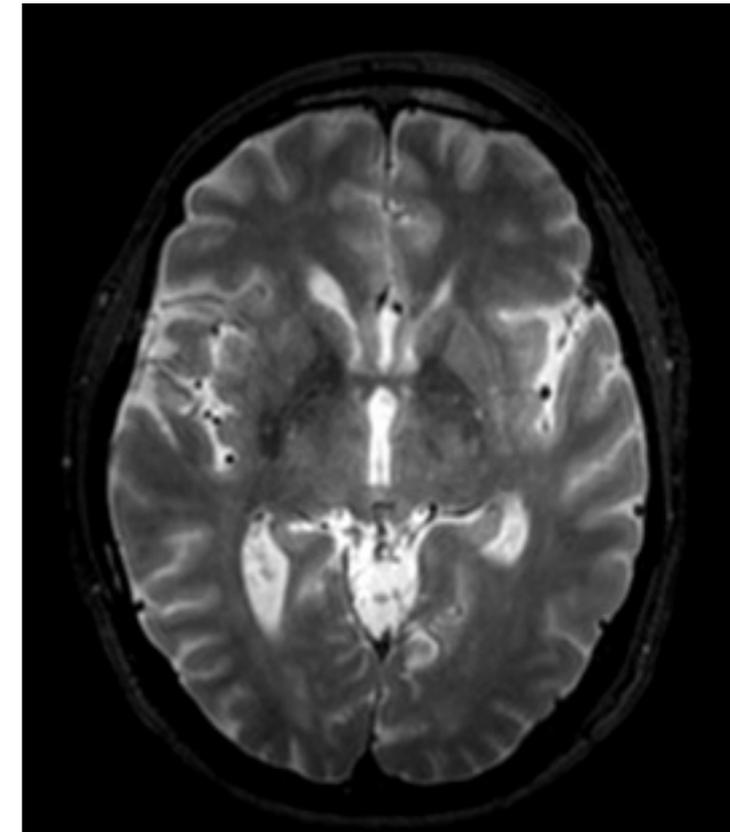
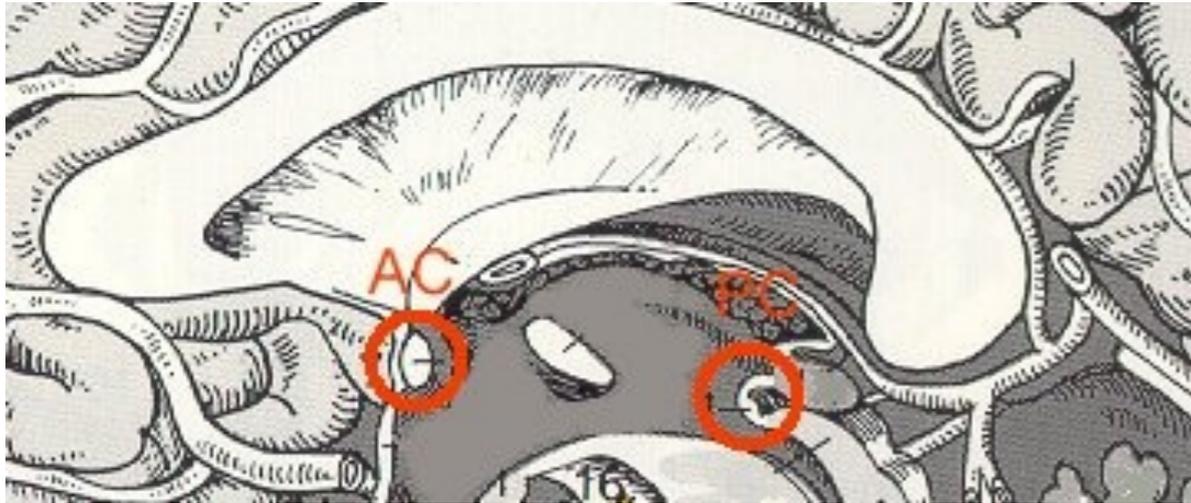
Anterior Commissure-Posterior Commissure



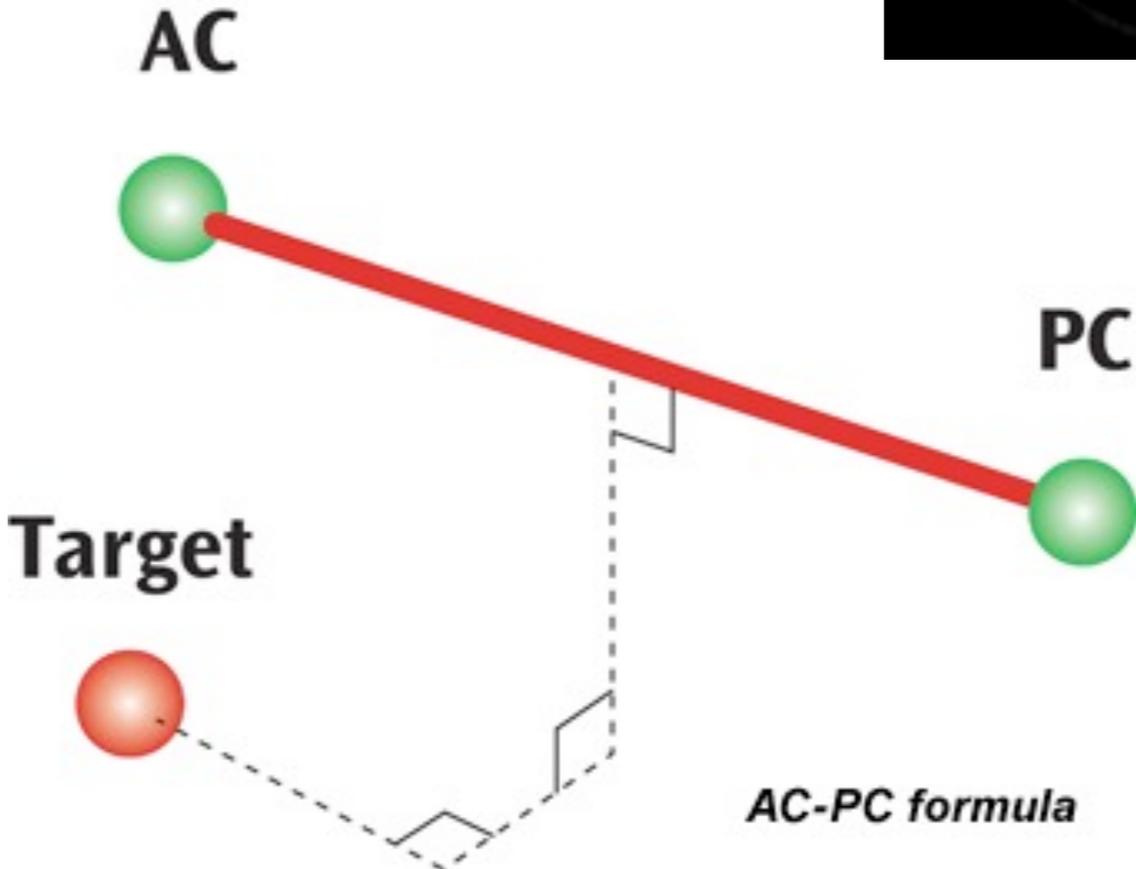
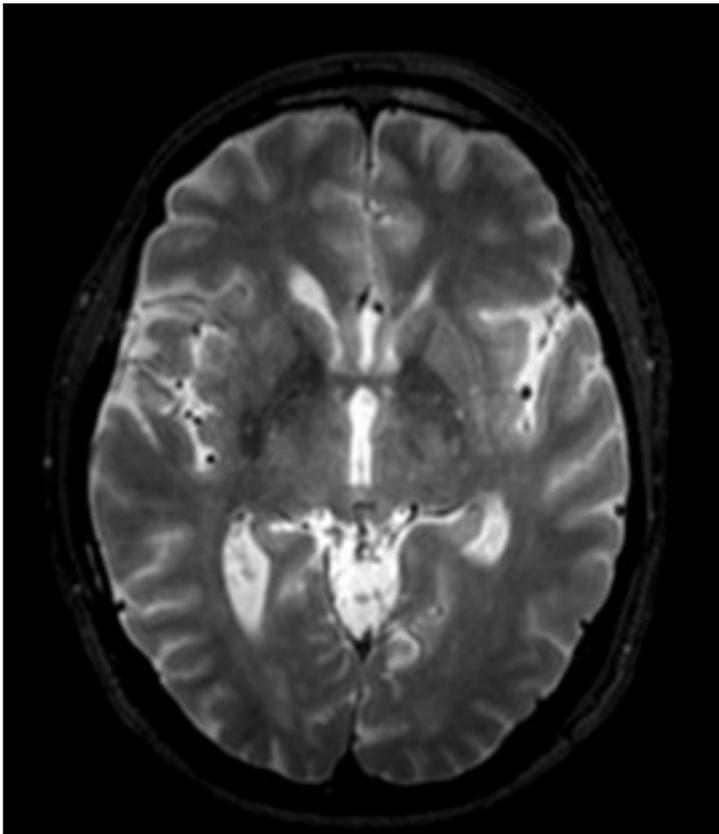
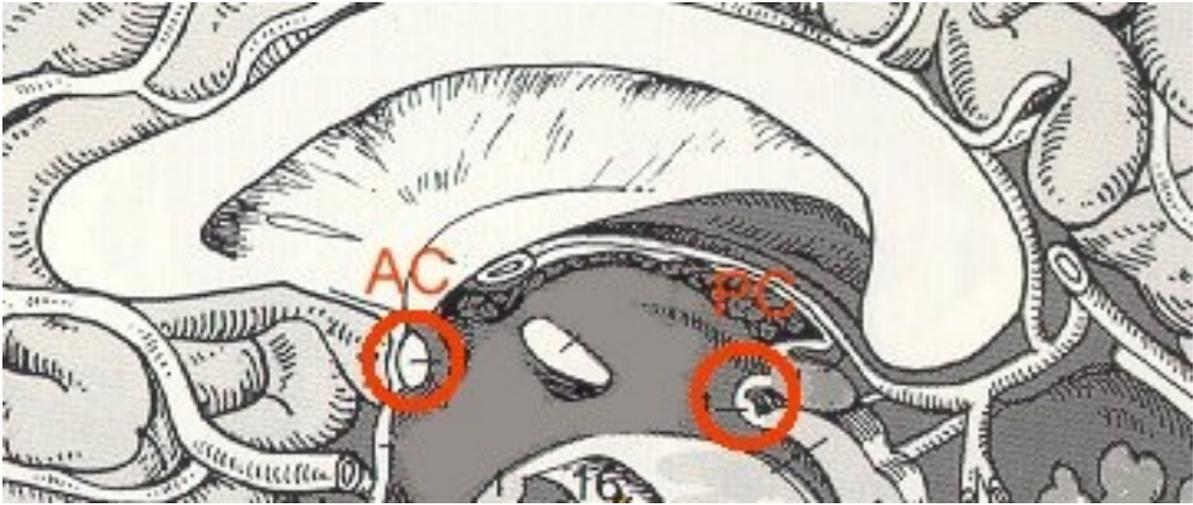
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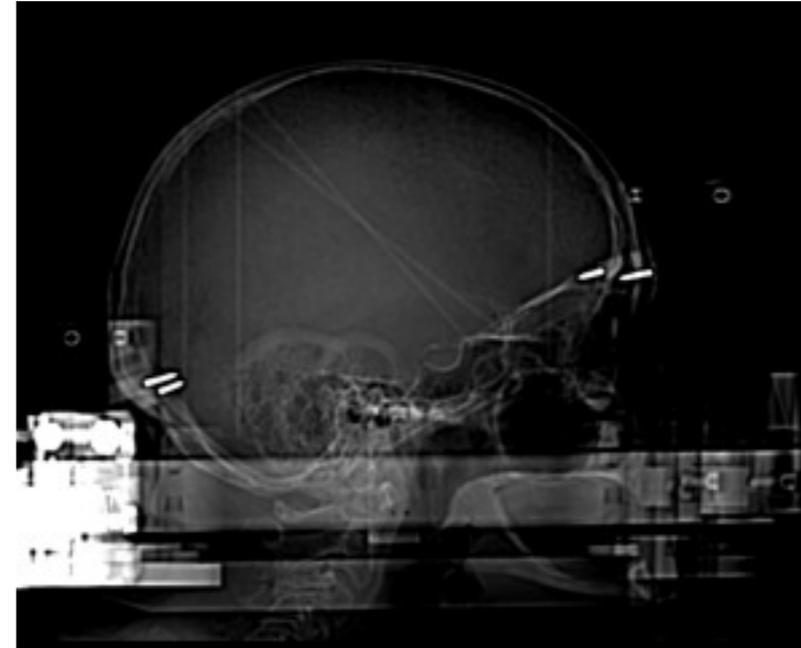
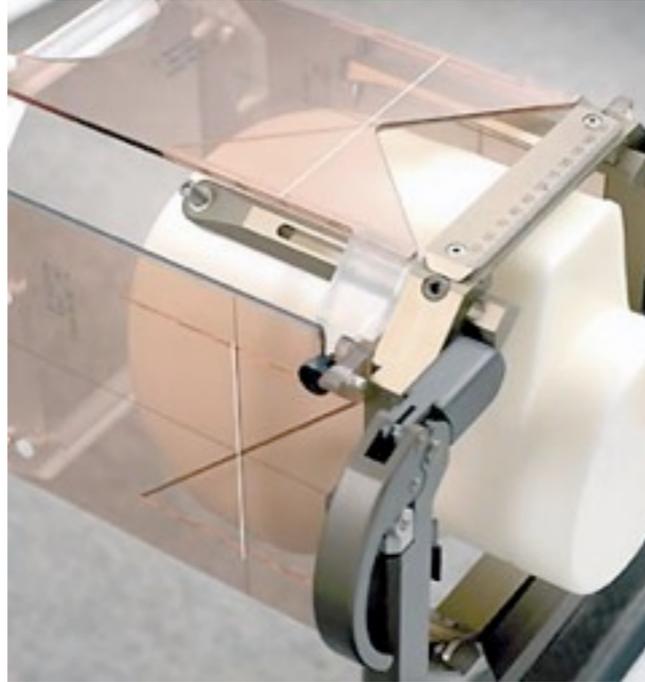
Anterior Commissure-Posterior Commissure



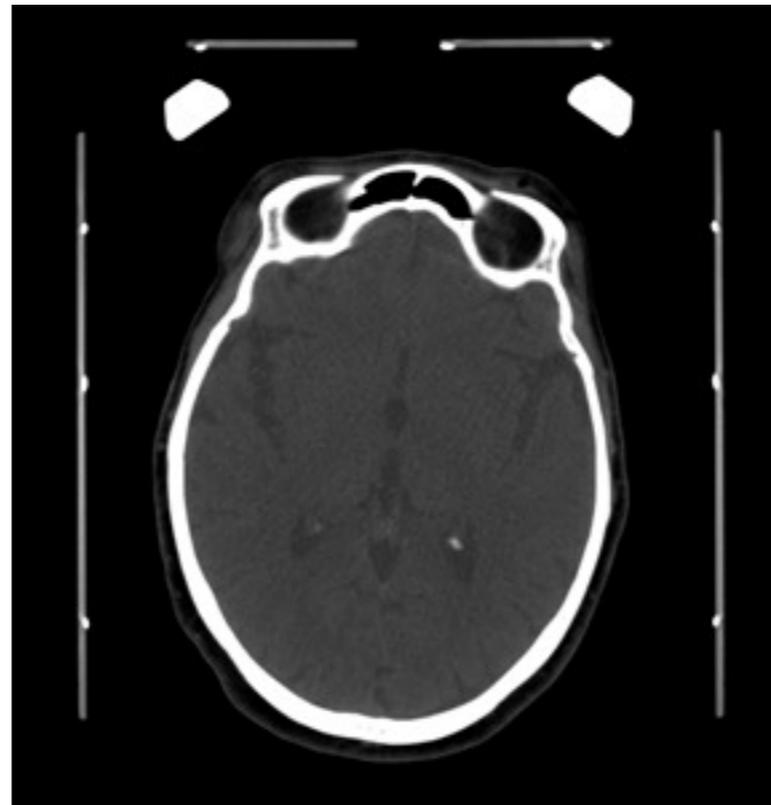
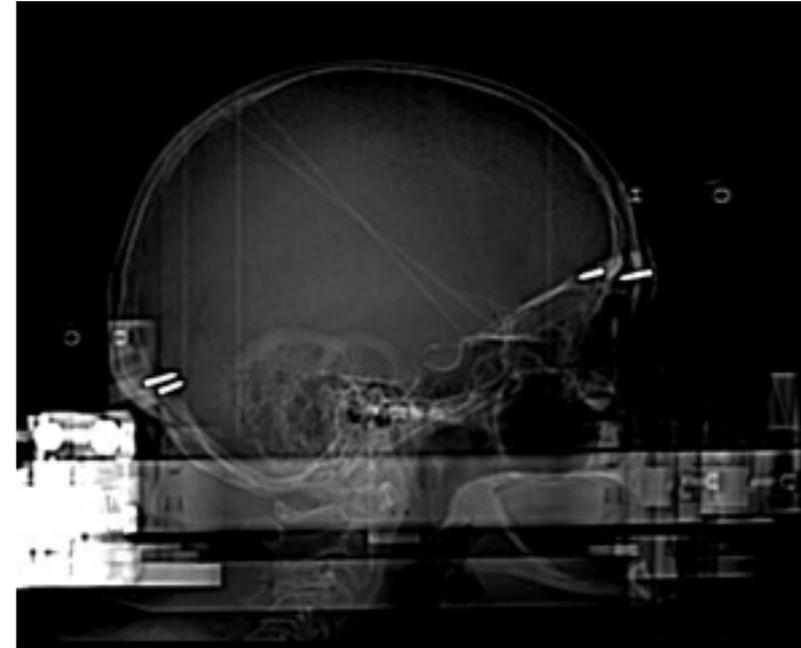
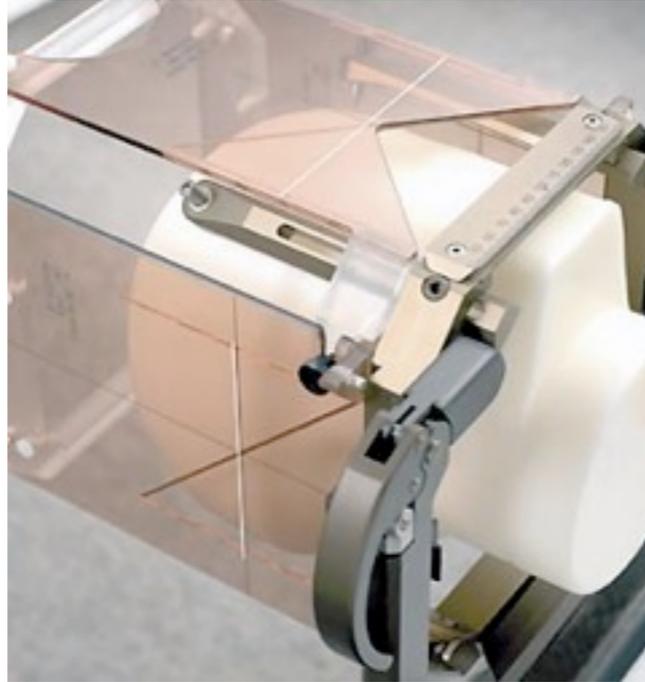
Anterior Commissure-Posterior Commissure



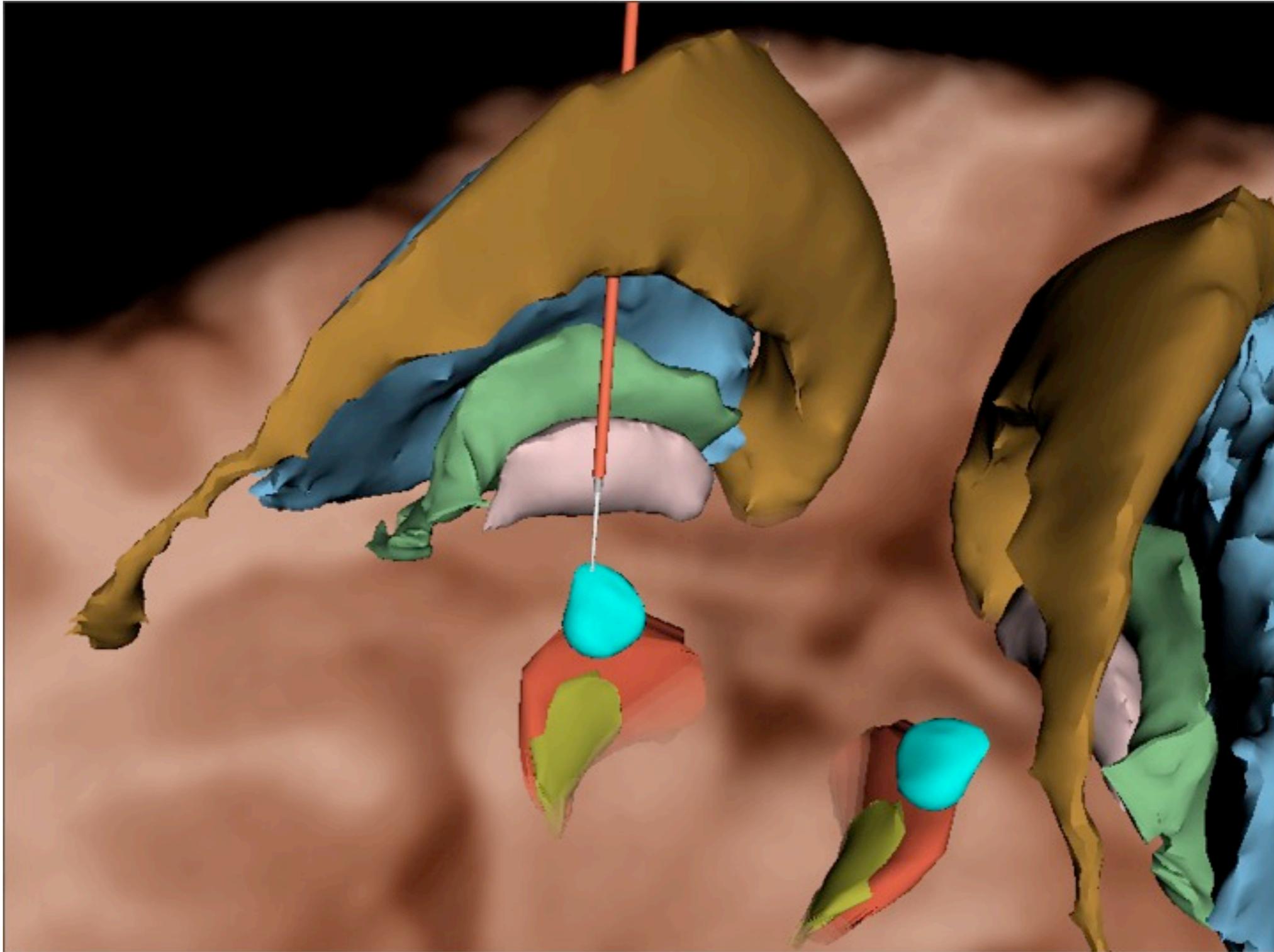
Stereotactic Neurosurgery



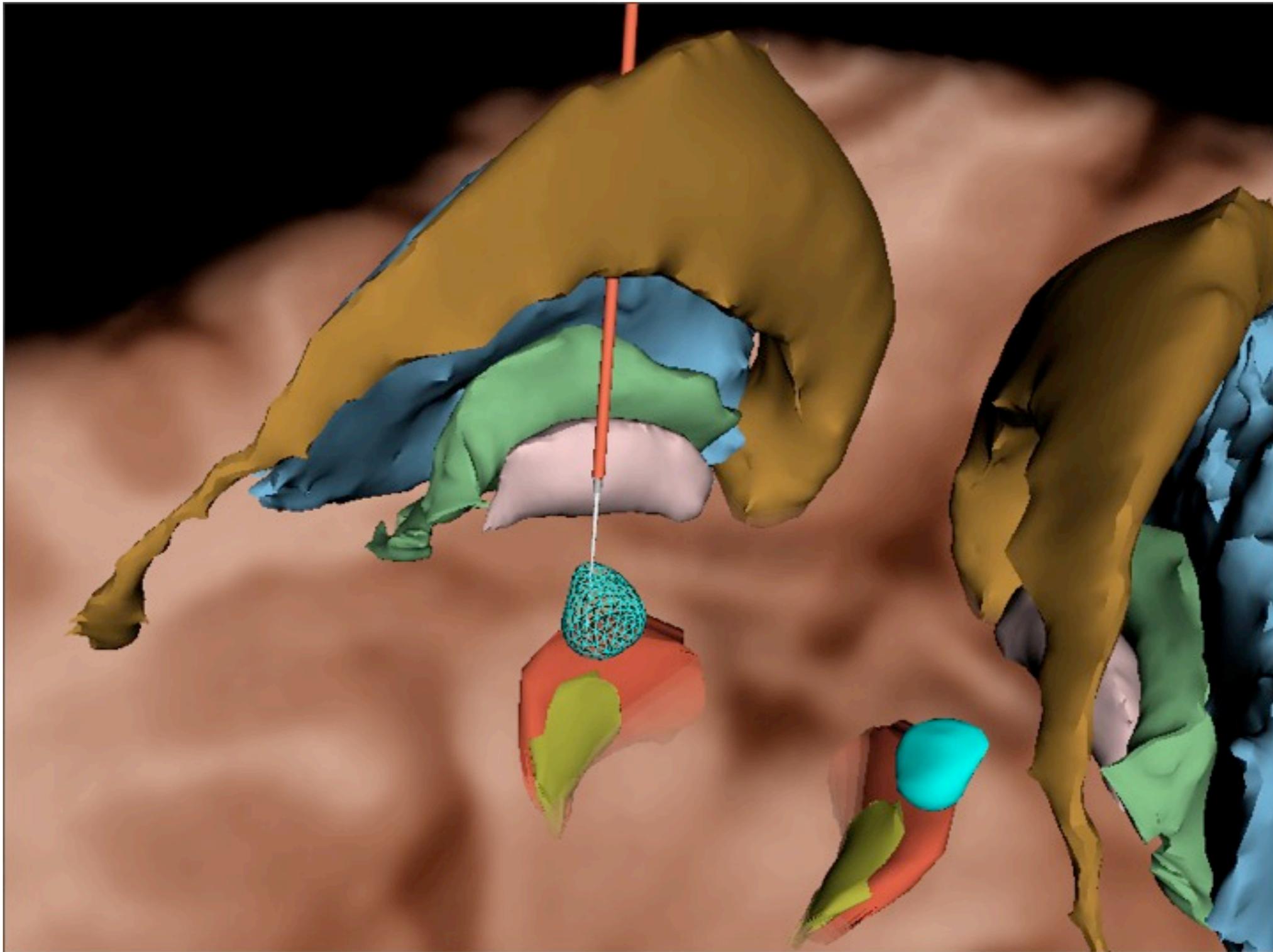
Stereotactic Neurosurgery



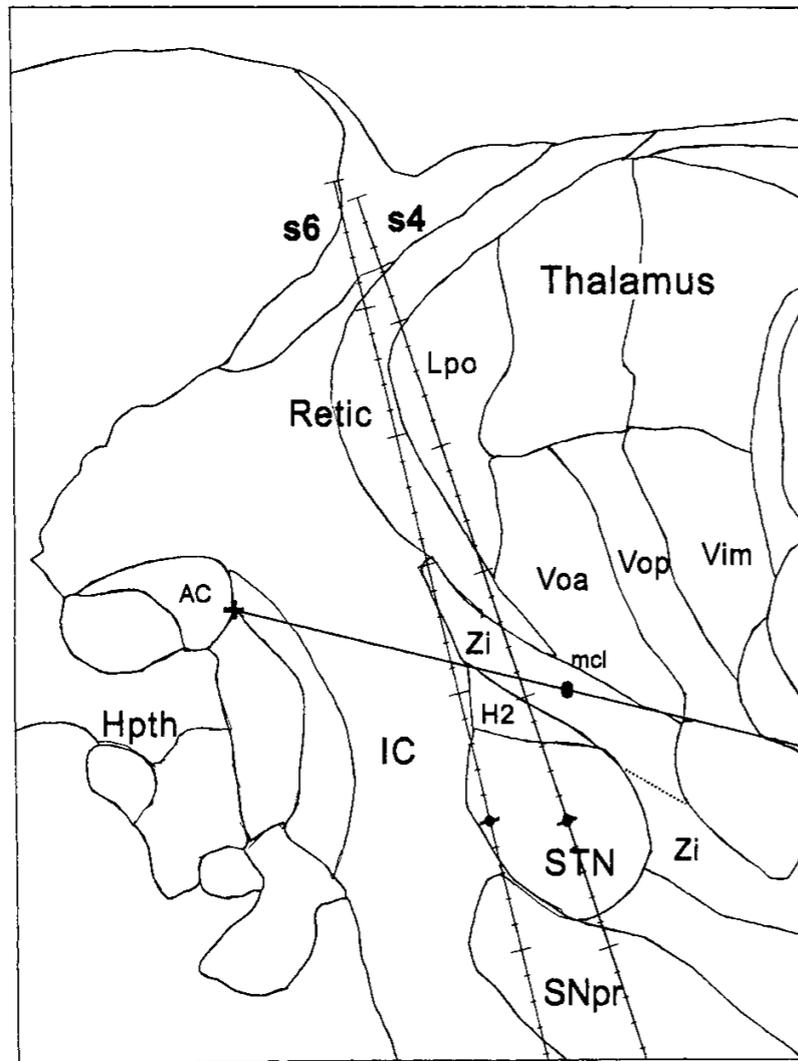
Microelectrode Recording (MER)



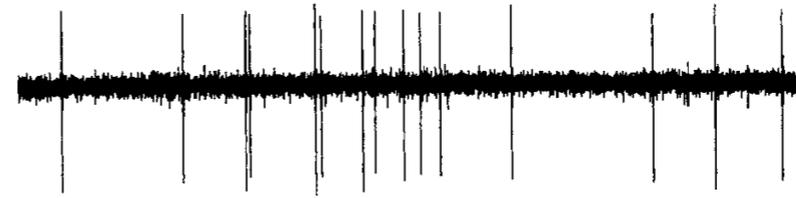
Microelectrode Recording (MER)



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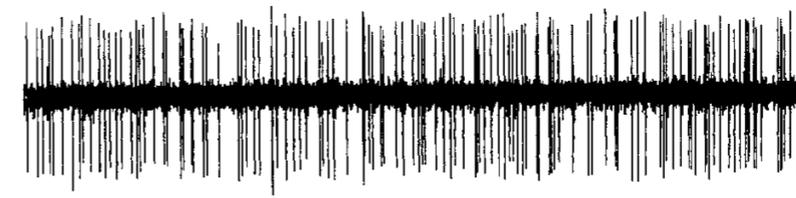
Rt Type A



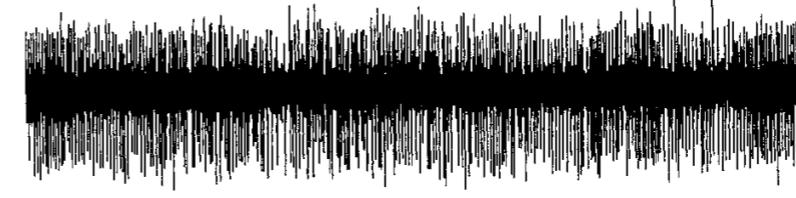
Rt Type B



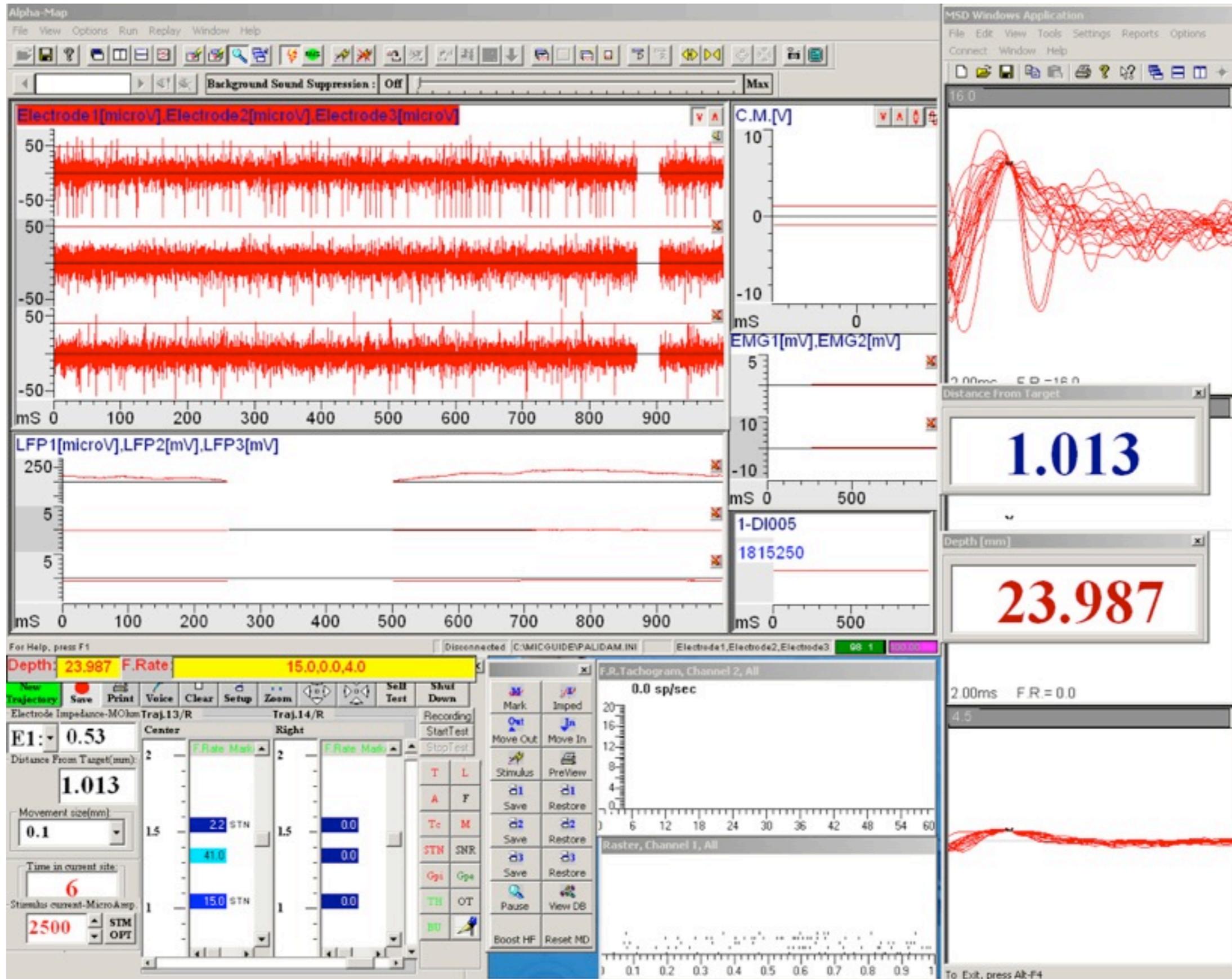
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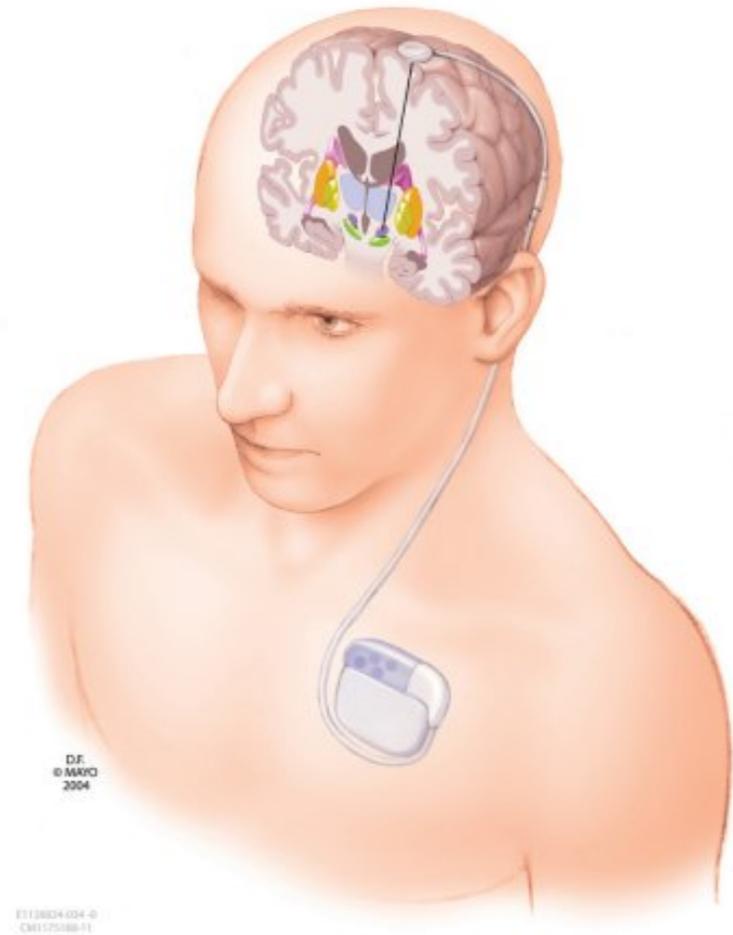
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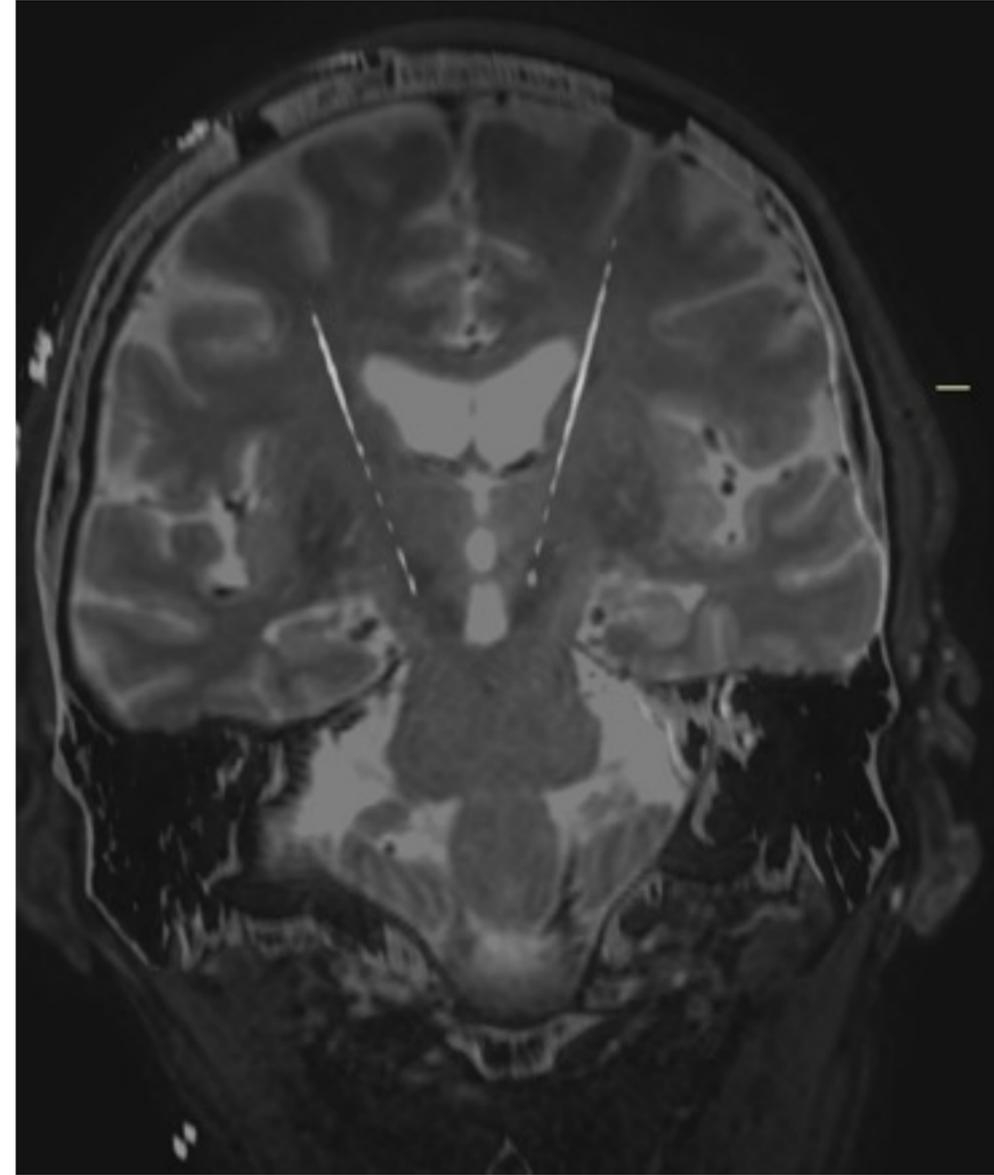
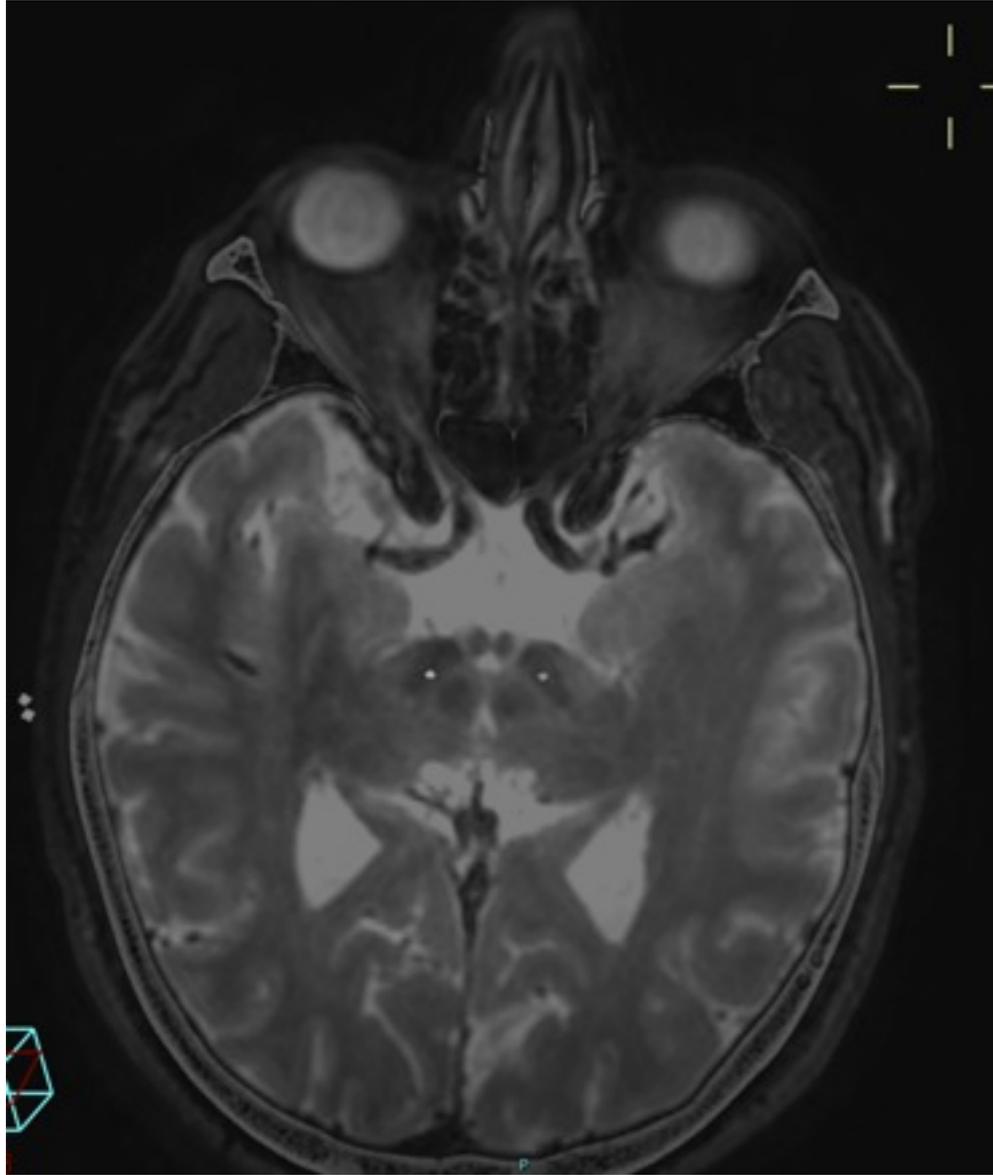
Microelectrode Recording (MER)



Deep Brain Stimulation

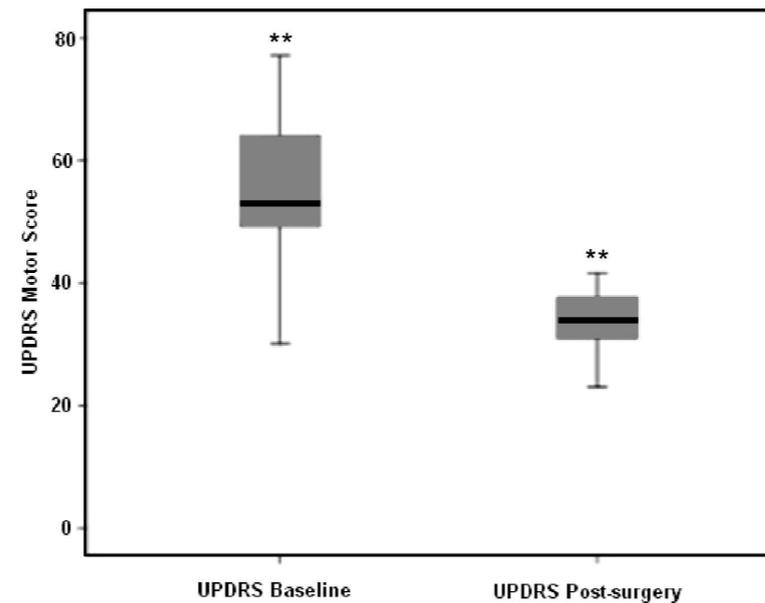


Deep Brain Stimulation



Efficacy PD

Time	Best Medical Therapy (n = 134)			Deep Brain Stimulation (n = 121)		
	Baseline, Mean (SD)	6 mo, Mean (SD)	Mean Difference (95% CI)	Baseline, Mean (SD)	6 mo, Mean (SD)	Mean Difference (95% CI)
On, h/d ^b						
Without troublesome dyskinesia	7.0 (2.9)	7.1 (3.3)	0 (-0.5 to 0.5)	6.4 (2.7)	10.9 (4.2)	4.6 (3.8 to 5.3)
With troublesome dyskinesia	4.2 (3.1)	3.9 (3.3)	-0.3 (-0.8 to 0.3)	4.4 (3.1)	1.8 (3.0)	-2.6 (-3.3 to -2.0)
Off, h/d ^b	5.6 (2.9)	5.7 (2.8)	0 (-0.4 to 0.5)	5.9 (2.6)	3.4 (3.1)	-2.4 (-3.1 to -1.8)
Asleep, h/d	7.1 (1.7)	7.3 (2.0)	0.3 (0 to 0.6)	7.3 (1.8)	7.7 (2.0)	0.4 (0 to 0.7)



Efficacy

Subthalamic Nucleus

Rigidity and bradykinesia; ~40% reduction of medication

Globus Pallidus

Rigidity and bradykinesia

Ventral Intermediate Nucleus (Thalamus)

Tremor suppression

Efficacy

Subthalamic Nucleus

Rigidity and bradykinesia; ~40% reduction of medication

Globus Pallidus

Rigidity and bradykinesia

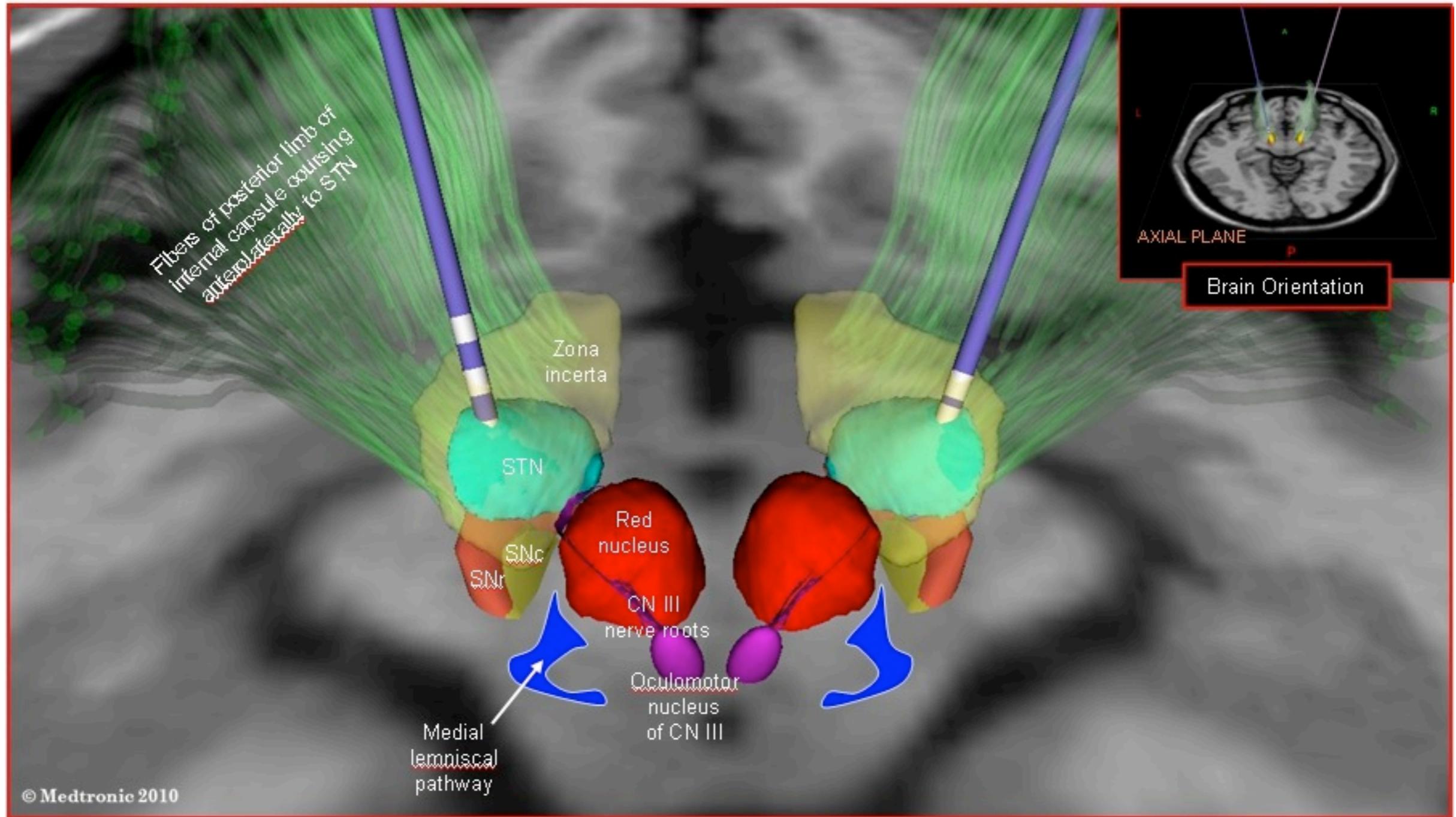
Ventral Intermediate Nucleus (Thalamus)

Tremor suppression

Pedunculopontine Nucleus

Gait and postural instability

Deep Brain Stimulation



Thank you

