

## Devices

- Some Deliver Drugs
- Some Monitor
- Some are Therapies



## Neuromodulation Therapies

Invasive: Deep Brain Stimulation (DBS)

Noninvasive:

- Transcranial Magnetic Stimulation (TMS)
- Transcranial Direct-Current Stimulation (tDCS)
- Electroconvulsive Therapy (ECT)



## Neuromodulation Therapies

**TMS**  
A. Transcranial magnetic stimulation

**DBS**  
B. Deep brain stimulation

**ECT**  
C. Electroconvulsive therapy

The diagram illustrates three neuromodulation therapies. Part A (TMS) shows a magnetic coil over the head and a diagram of NMDAR and AMPAR receptors with calcium signaling. Part B (DBS) shows a brain cross-section with a lead in the subthalamic nucleus (STN) and a graph of electrical pulses. Part C (ECT) shows an ECT device over the head. The University of Minnesota logo and 'Driven to Discover' slogan are present. A URL <https://doi.org/10.1503/cmaj.121317> is provided.

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Udall Center**

**Deep Brain Stimulation**

**Amplitude:** <5 V  
**Rate:** 80-180 Hz  
**Pulse Width:** 60-240  $\mu$ s

Thalamus, STN, Globus Pallidus, DBS Lead

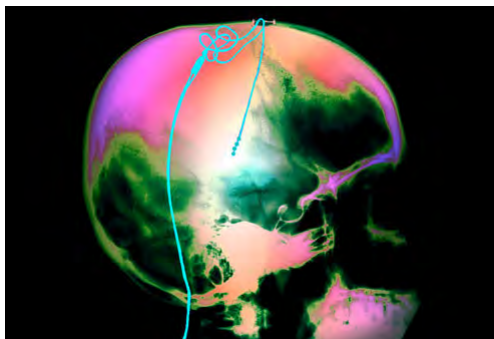
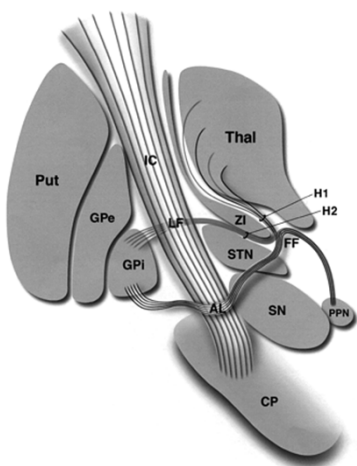
2 mm

0, 1, 2, 3 } DBS electrode contacts

Johnson, et al. (2011) Youman's Neurological Surgery Textbook

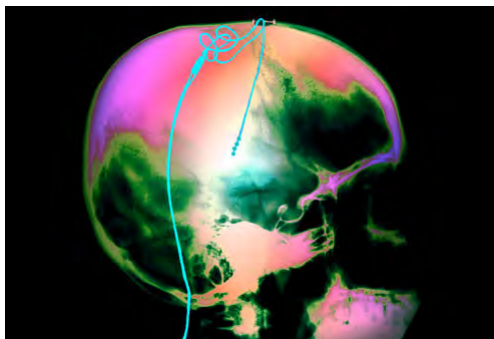
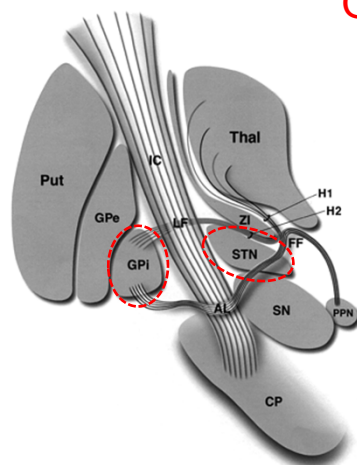
University of Minnesota logos and 'Driven to Discover' slogan are present. A circular logo for the 'Udall Centers of Excellence for Parkinson's Disease Research' is also shown.

## What Sites Treat Bradykinesia?



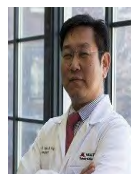
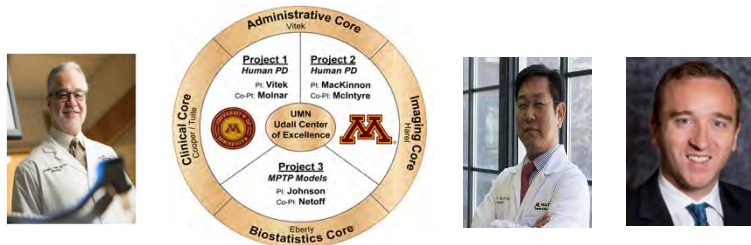
## What Sites Treat Bradykinesia?

GPI and STN



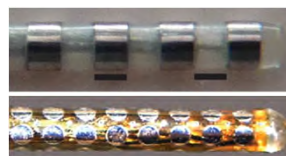
# University of Minnesota Udall Center

Center of Excellence for Parkinson's Disease Research

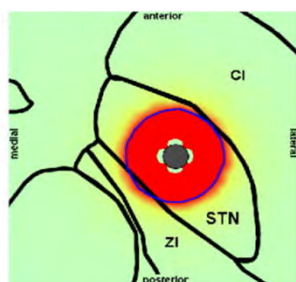


## Advancing DBS Therapy

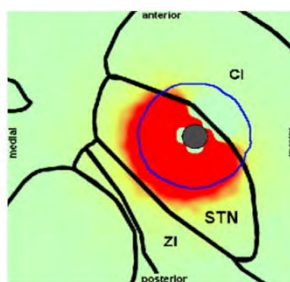
**Novel DBS Leads:**  
Improving accuracy and avoiding side effects?



Well-targeted DBS lead



Off-target DBS lead

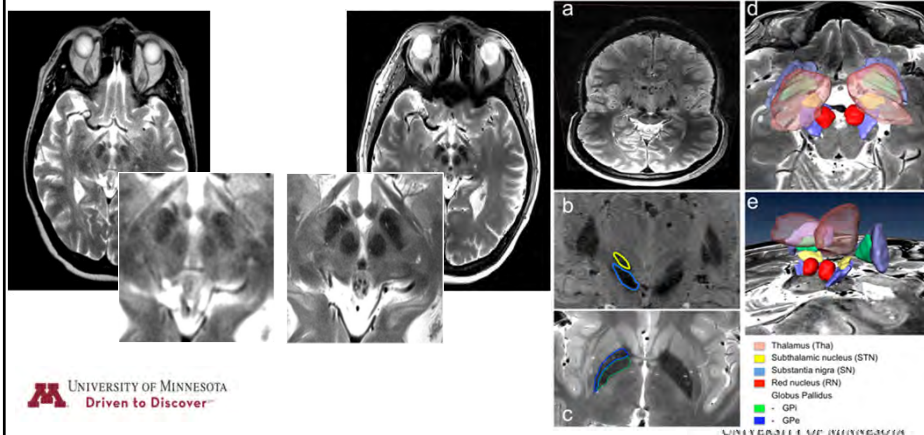


# 7 Tesla Brain Imaging



1.5T vs 7T

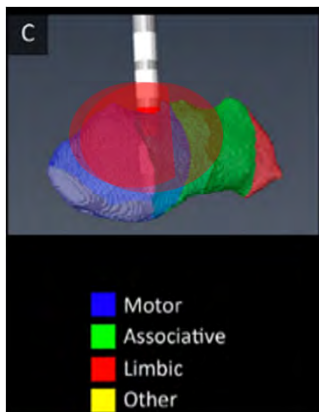
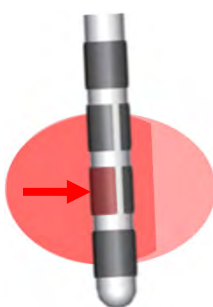
Patient-specific anatomical



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## Personalized Medicine: Use new technology to Optimize Stimulation



Select areas and different ways to stimulate to maximize benefit and minimize side effects

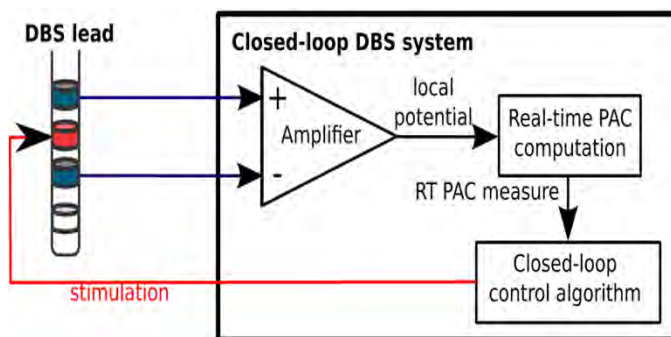
Image from: Platts-Jones BR, Temel Y, Durrin Y, et al. Individualized parcellation of the subthalamic nucleus in patients with Parkinson's disease with 7T MRI. NeuroImage. September 2016. doi: 10.1016/j.neuroimage.2016.09.023

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## Advancing DBS Therapy

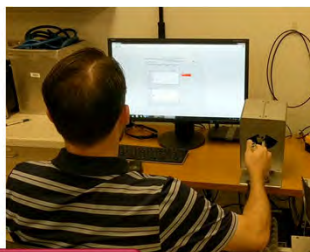
**Closed-Loop DBS:** Using a patient's own brain activity to control stimulation settings



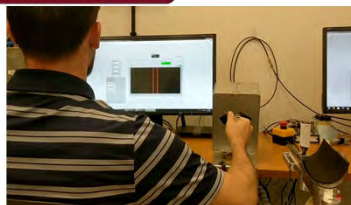
## Measure of Rigidity: May Aid DBS Programming



Rigidity



Repetitive Movements



## Understanding and improving DBS

7T MRI      Modelling DBS      Testing Motor Function

Movement Disorders Laboratory  
Department of Neurology  
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## Skin Cancer and PD

Melanoma

Basal Carcinoma

Basal cell carcinoma      Squamous cell carcinoma

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## Recap

- Sleep disorders & loss of smell may be the first feature of a degenerative brain disorder like PD
- A focus of medication Rxs: stable levodopa levels
- Alpha-synuclein antibodies as a possible Rx strategy
- Exercise is a treatment. Move It.
- Deep Brain Stimulation: better MRI images, newer electrodes, improved programming, etc.
- Safety: employ pharmacist/others to deliver medications on time and eliminate unnecessary or counter productive medications, e.g., benzodiazepines, anticholinergics, etc.



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Questions?  
contact [info@mngero.org](mailto:info@mngero.org)

Next Webinar: **November 12, 2019, Noon - 1:00 pm**

**Strategies for Home Modification/Access Financing**  
By: Diane Sprague, MA, Owner, Lifetime Home Project

