Deep Brain Stimulation Technology

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Introduction

- What is DBS Technology?
- Why is it important?

A Brief History

- Scribonius Largus, 50AD
  - Electrical torpedo fish to treat headaches/gout
- Luigi Galvani, 1786
  - Conducted electricity through frogs leg nerves
- Alessandro Volta
  - Current through wire- built a basic but working battery

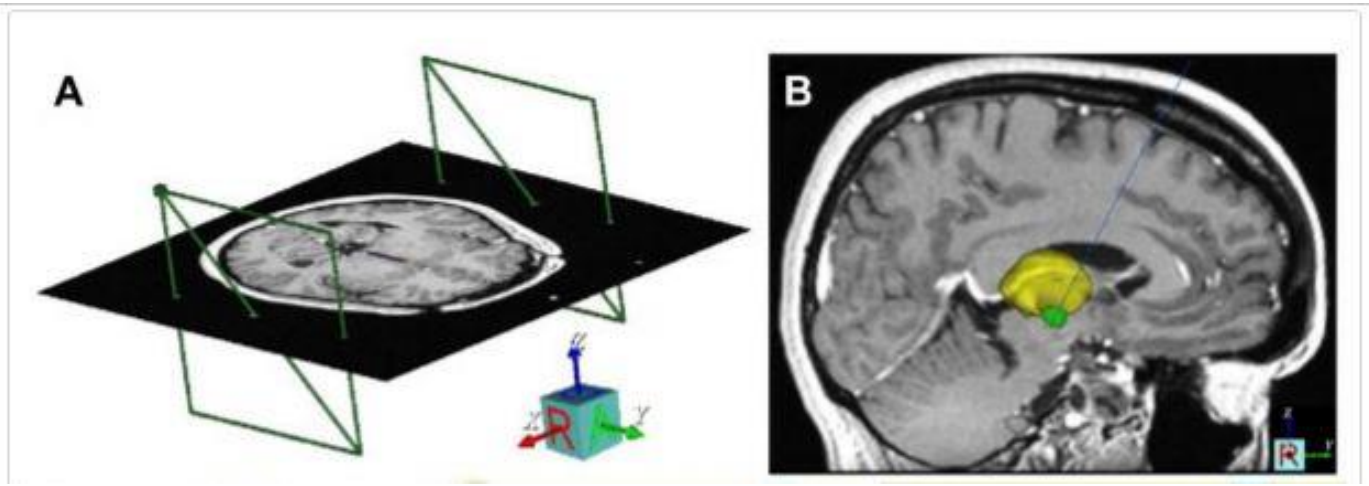
Picture found on:
http://www.pbase.com/image/117444919

Okun, M. Deep-Brain Stimulation- Entering the Era of Human Neural-Network Modulation. *New England Journal of Medicine*. 371: 1369-1373, 2014.

Surgery

- Pre-operative target planning to determine electrode placement
- Hole drilled in skull
- Electrode placement

- 4.5 hours for unilateral implant, 6 hours bilateral implant



McIntyre, C; Chaturvedi A; et al. Engineering the Next Generation of Clinical Deep Brain Stimulation Technology. *Brain Stimulation*. 8(1): 21-26, 2015.

Risks

Surgery

Brain Bleed

Stroke

Infection

Breathing Problems

Nausea

Heart Problems

Incision scarring

Post Surgery

Seizure

Infection

Headache

Insomnia

Memory problems

Temporary pain/swelling

Side effects of Stimulations

Numbness/tingling sensations

Muscle tightness in face/arms

Speech and balance problems

Lightheadedness

Mood Swings

Mayo Clinic Staff. "Deep Brain Stimulation." *Risks*. Mayo Clinic, 2015. <http://www.mayoclinic.org/tests-procedures/deep-brain-stimulation/basics/risks/prc-20019122>

Programming DBS

- Programming done post-op
- Various variables to consider
  - Electrode polarity
  - Amplitude
  - Pulse width
  - Frequency
- Increase until finding desired effect
- Process is about 20 hours

Picture from: Liker, M; Won, D; Vikas, R; et al. Deep Brain Stimulation: An Evolving Technology. *Proceedings of the IEEE*. 96(7): 1129-1141, 2008.

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Volkmann, Jens; Moro, Elena; Pahwa, Rajesh. Basic algorithms for the programming of deep brain stimulation in Parkinson's Disease. *Movement Disorders*. 21(14): S284-S289, 2006.

Conclusion

- Very helpful for people with Parkinson's, OCD, and other related diseases
- Looking into using this for depression, anxiety, and other related diseases

- Still needs a lot of work, but future looks bright

Sources

- Okun, M. Deep-Brain Stimulation- Entering the Era of Human Neural-Network Modulation. *New England Journal of Medicine*. 371: 1369-1373, 2014.
- McIntyre, C; Chaturvedi A; et al. Engineering the Next Generation of Clinical Deep Brain Stimulation Technology. *Brain Stimulation*. 8(1): 21-26, 2015.
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- Liker, M; Won, D; Vikas, R; et al. Deep Brain Stimulation: An Evolving Technology. *Proceedings of the IEEE*. 96(7): 1129-1141, 2008.
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