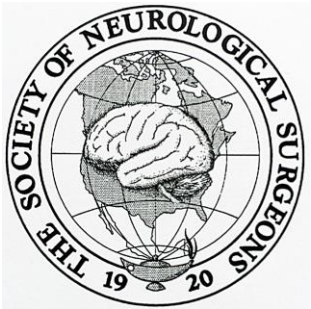
Introduction to Neurosurgical Subspecialties:

Functional Neurosurgery

Brian L. Hoh, MD[1] and Gregory J. Zipfel, MD[2]

[1]University of Florida, [2]Washington University



THE SOCIETY OF NEUROLOGICAL SURGEONS

Functional Neurosurgery

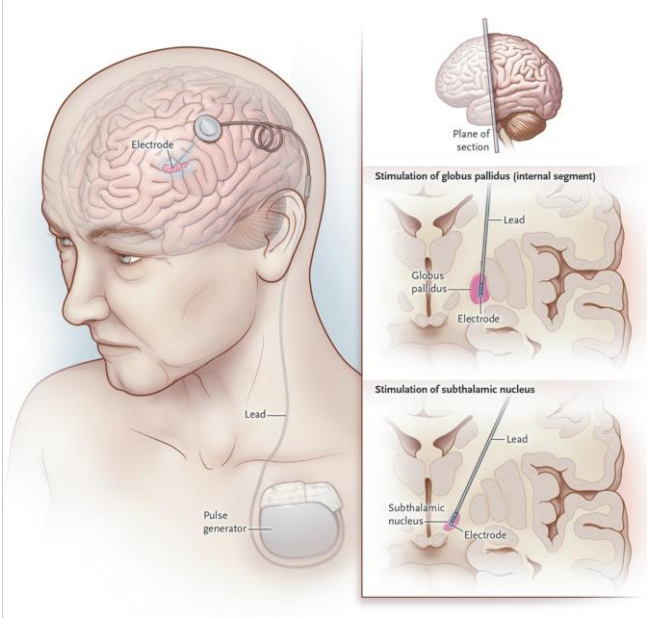
- Functional neurosurgery is about optimizing the function of patients
- Functional neurosurgeons treat patients with:
  - Movement disorders such as Parkinson's disease and tremor
  - Spasticity
  - Psychiatric disorders
  - Chronic pain syndromes

Functional Neurosurgery

- Fellowship not required for neurosurgeons, but some neurosurgeons opt for specialized training in functional surgery via fellowship
  - Different fellowships may have different emphasis (e.g. deep brain stimulation > epilepsy resections)

Functional Neurosurgery

- Deep brain stimulation
  - FDA approved for:
    - Essential tremor (1997)
    - Parkinson's disease (2002)
    - Dystonia (2003)
    - Obsessive compulsive disorder (2009)
  - Emerging indications:
    - Tourette's syndrome
    - Major depression
    - Alzheimer's disease



Okun MS, NEJM 2012

Functional Neurosurgery

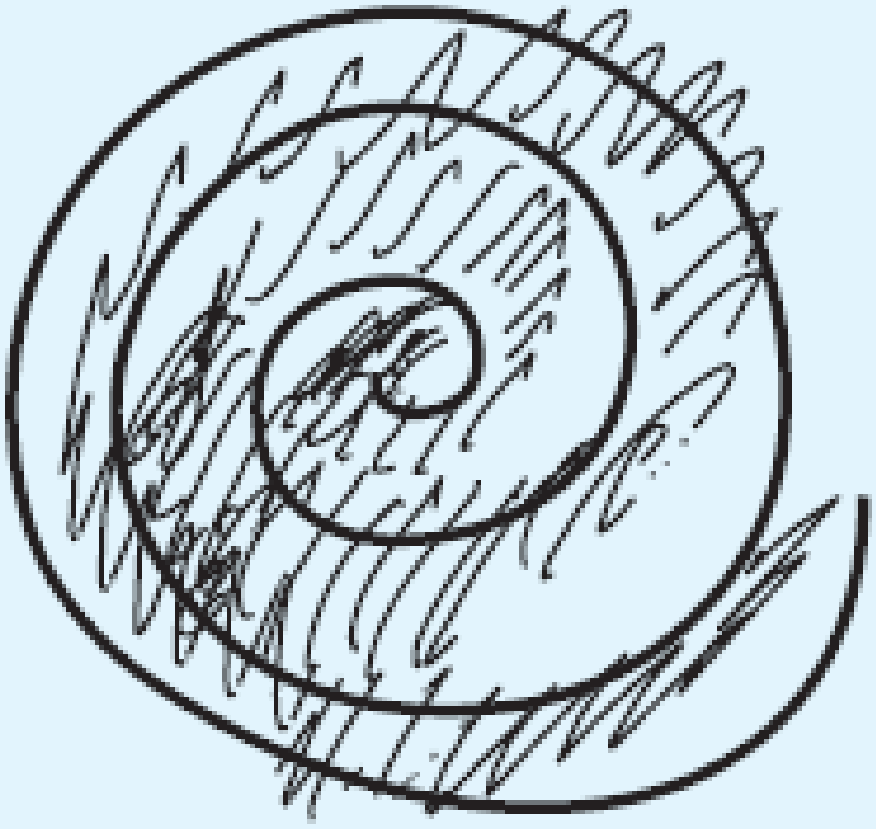
Case Illustration #1

72 y/o right handed male with 25 year history of bilateral upper extremity intention tremor. Failed medical therapy (propranolol, primidone). Unable to perform ADLs.

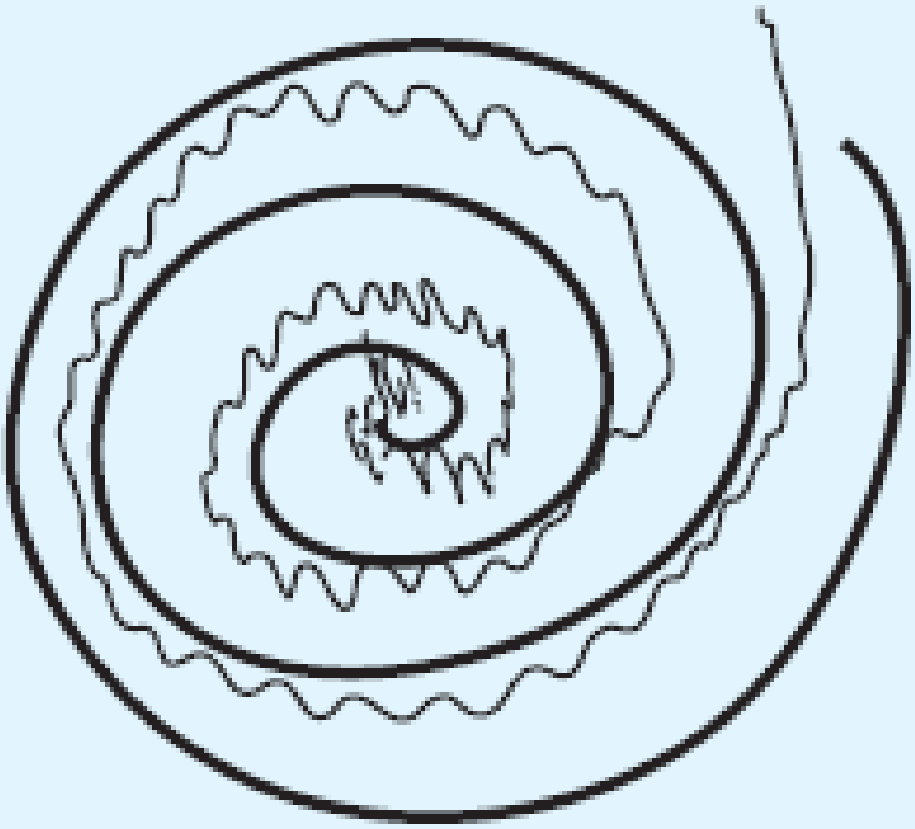
Pre-operative

Functional Neurosurgery

Case Illustration #1



Right hand

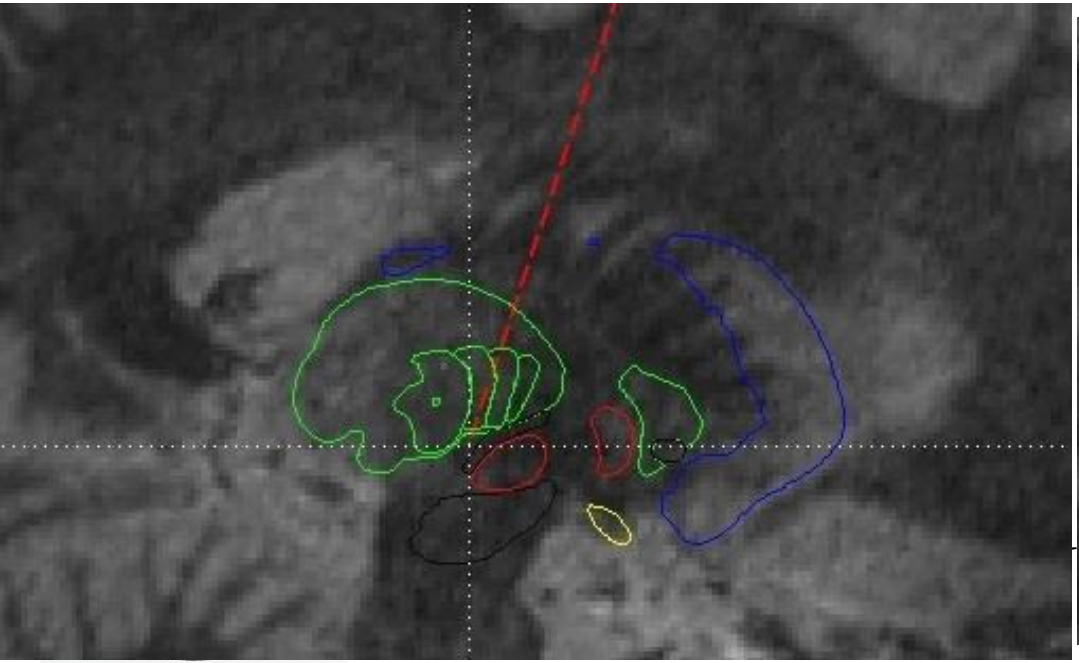


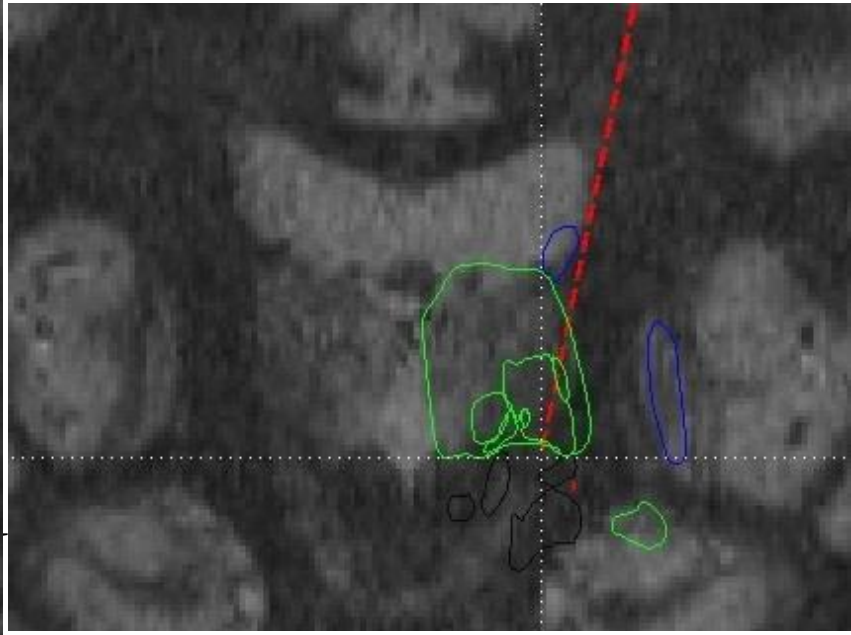
Left hand

Functional Neurosurgery

Case Illustration #1

- Essential tremor: characterized by gradually increasing-amplitude postural and kinetic tremor of the forearms and hands (with or without involvement of other body parts)
- Surgical plan: Implantation of single DBS lead into left VIM thalamus

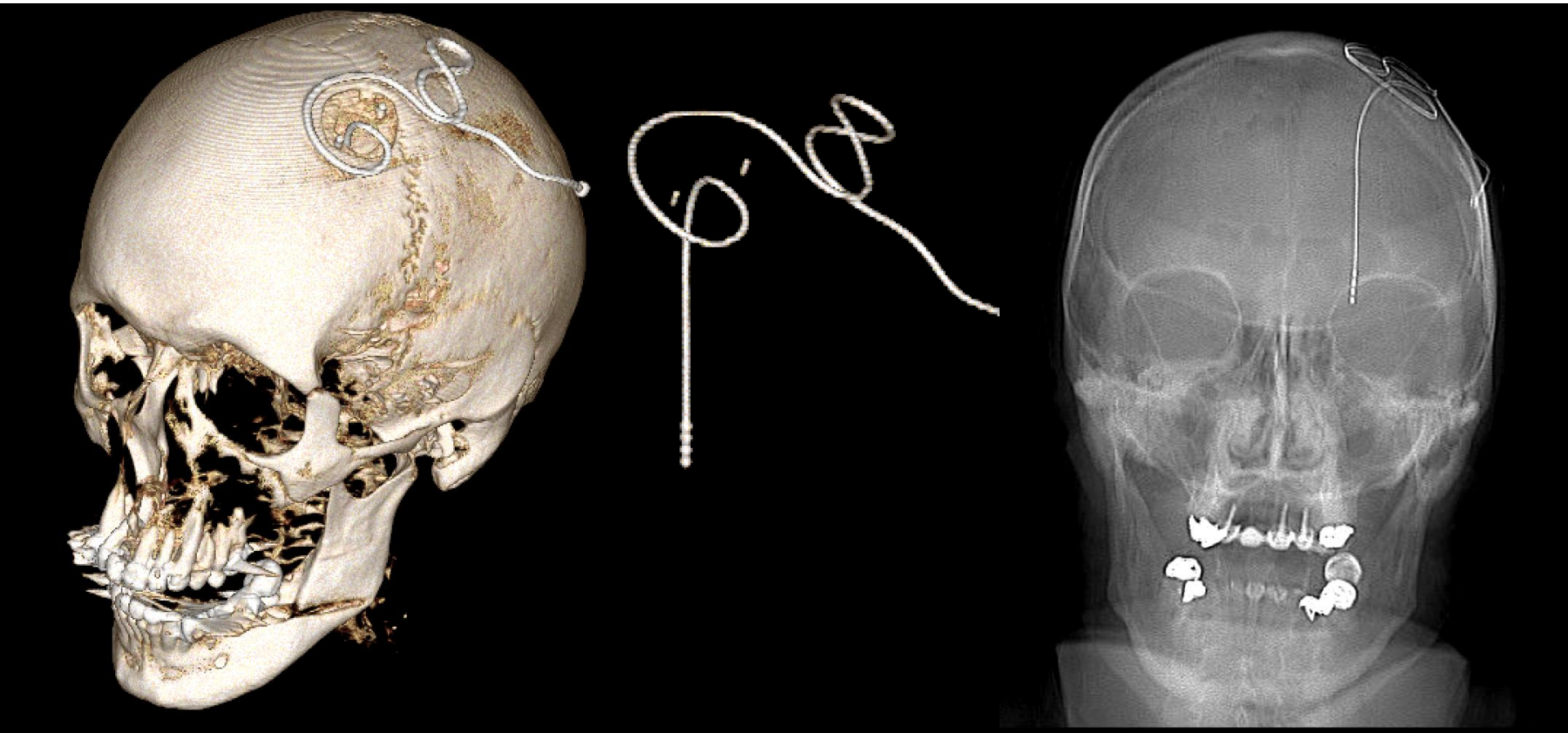




Intraoperative

Functional Neurosurgery

Case Illustration #1



Post-operative

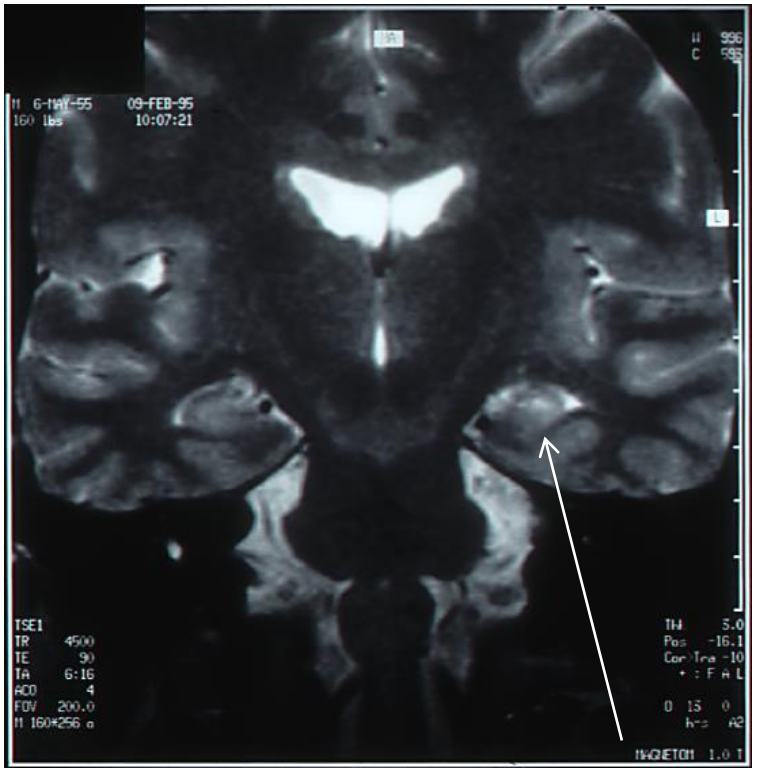
Epilepsy Neurosurgery

- Epilepsy neurosurgeons treat patients with:
  - Seizure disorders
  - Lesions causing seizures
  - Lesions requiring cortical mapping and/or monitoring

Epilepsy Neurosurgery

- Fellowship not required for neurosurgeons, but some neurosurgeons opt for further specialized training in epilepsy surgery via fellowship

Hippocampal Sclerosis

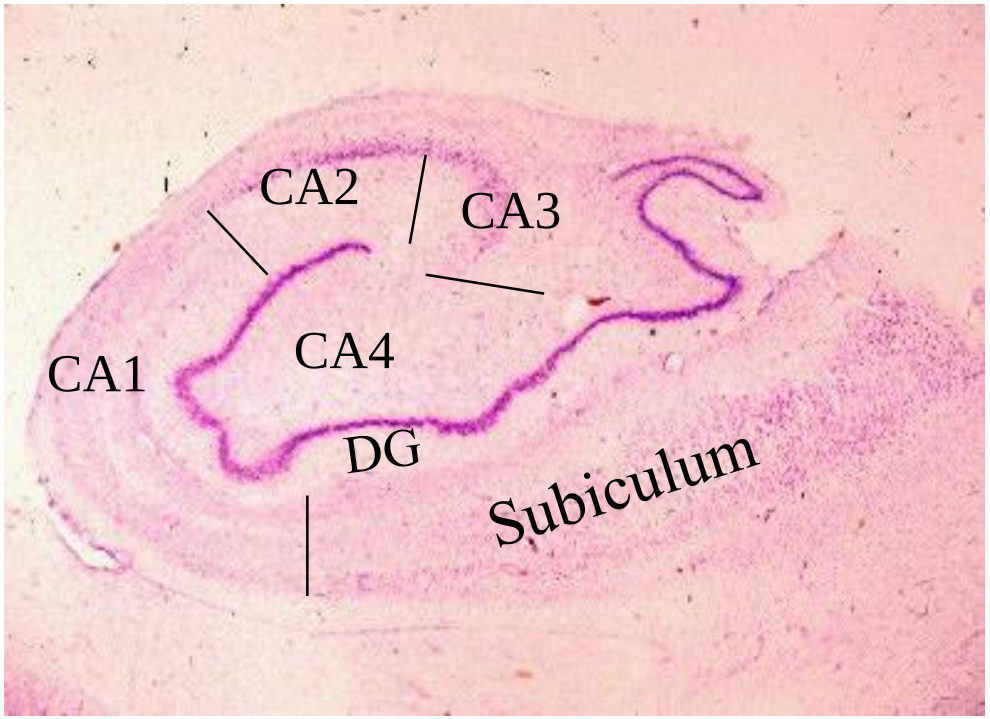


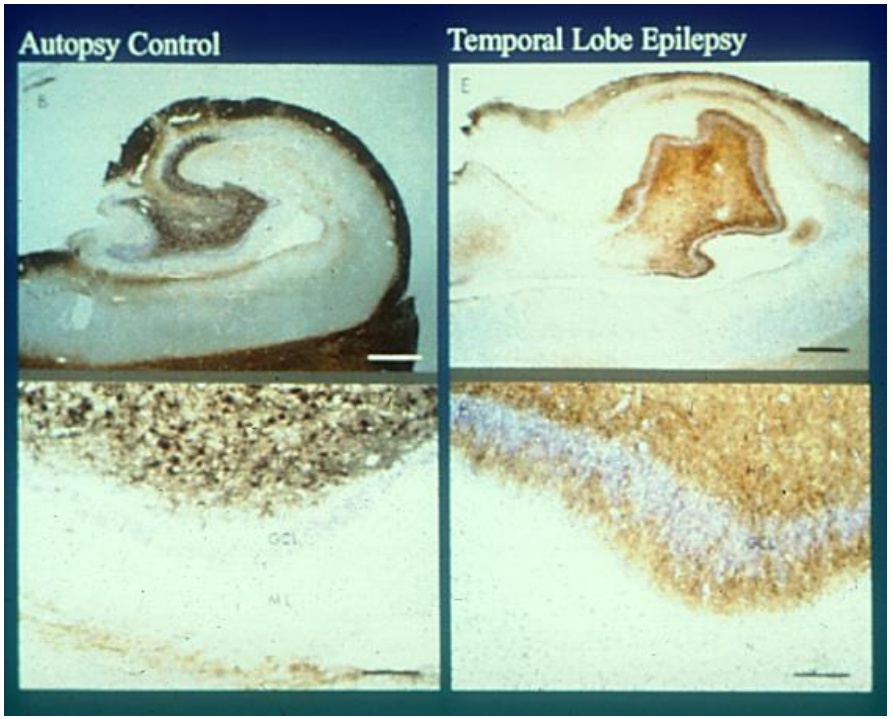
Pre-op

Post-op

THE SOCIETY OF NEUROLOGICAL SURGEONS

Hippocampal Sclerosis





THE SOCIETY OF NEUROLOGICAL SURGEONS

Depth Electrodes

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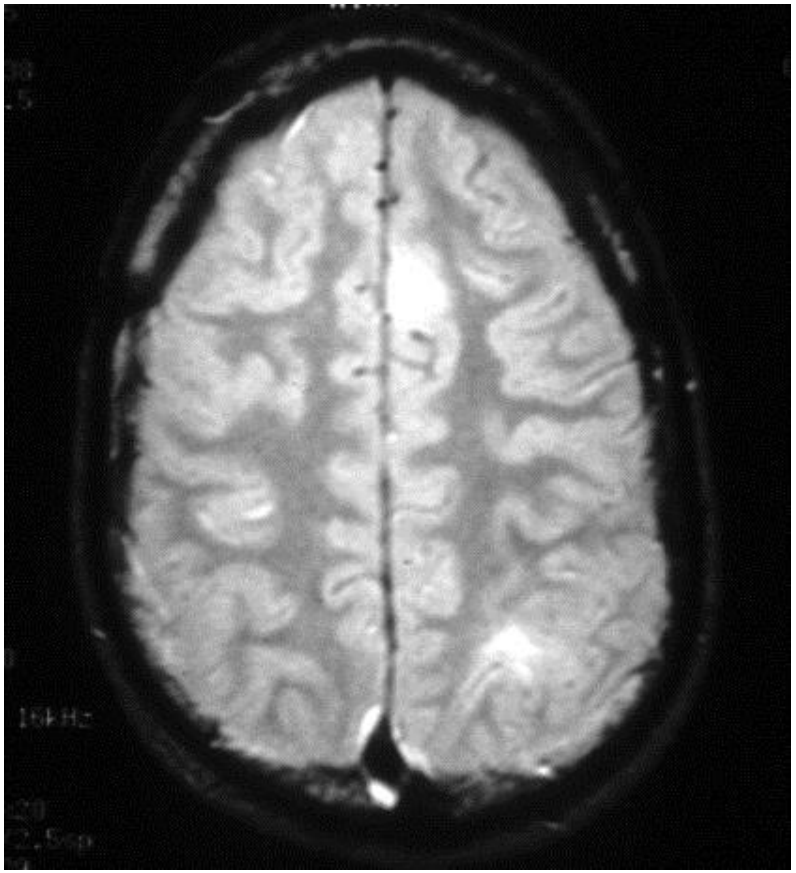
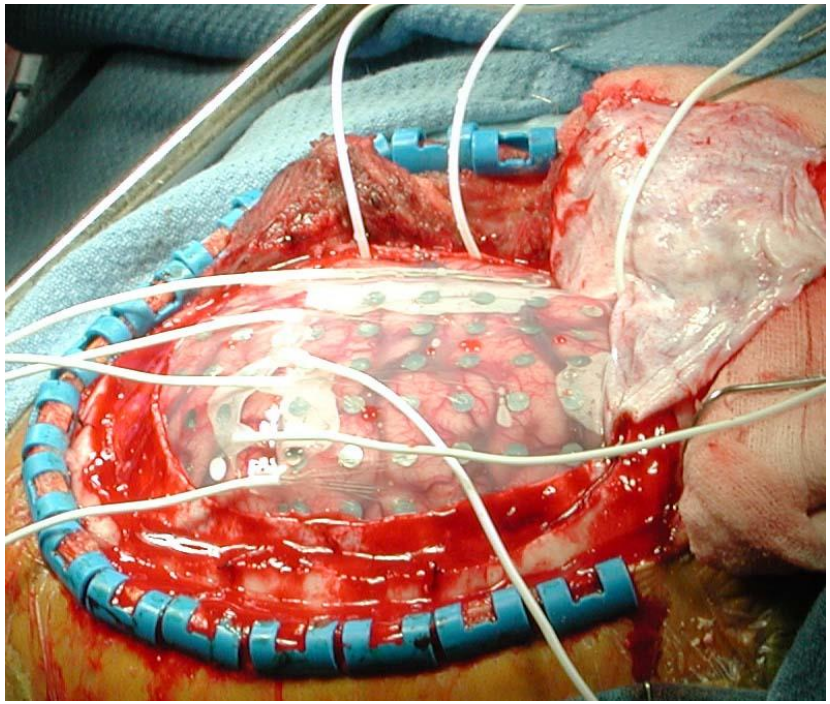
Defining Physiology/Function

- EEG/ECoG
- MEG
- Wada
- Mapping
- fMRI
- Ictal SPECT

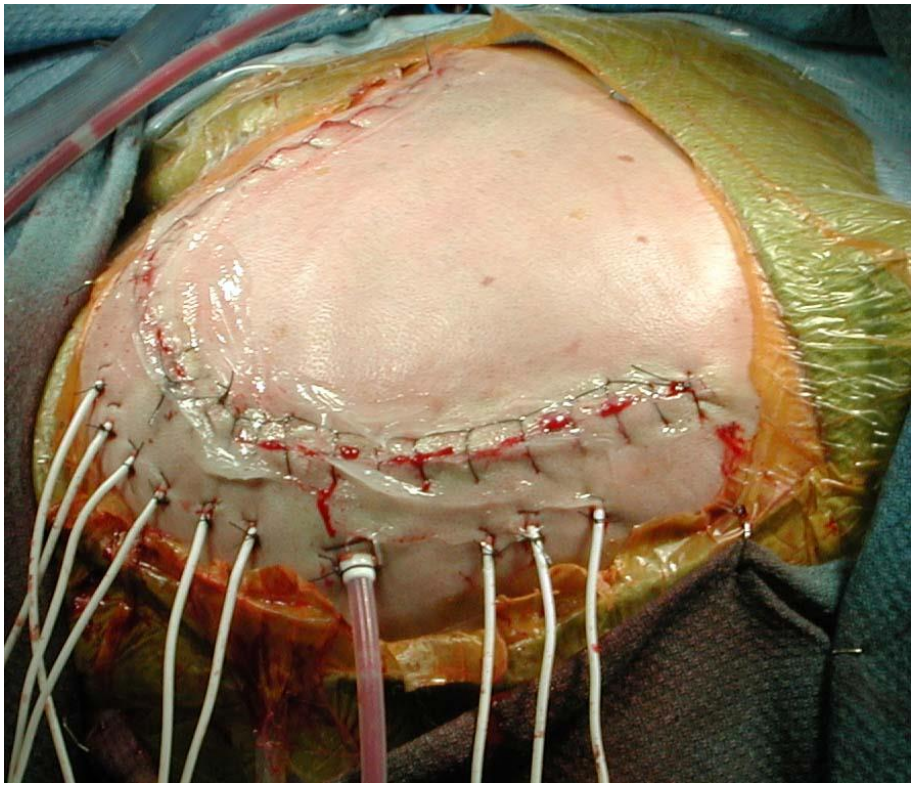


Tuberous Sclerosis



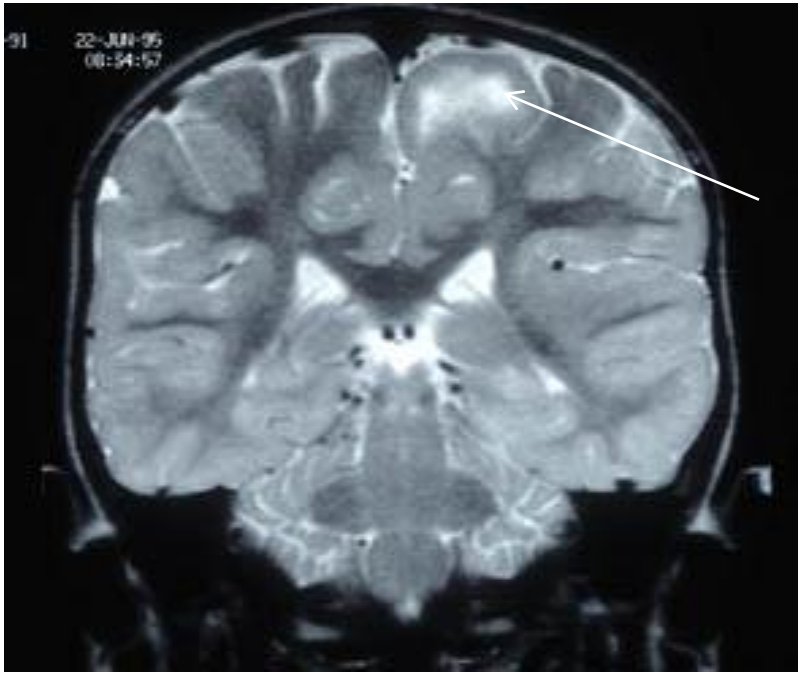
Subdural Electrodes

Define seizure onset
Stimulation mapping



Disorders of Cortical Development

- Cortical Dysplasia
- TS
- Heterotopia
- Pachygyria
- Schizencephaly
- Polymicogyria
- Hemimegalencephaly

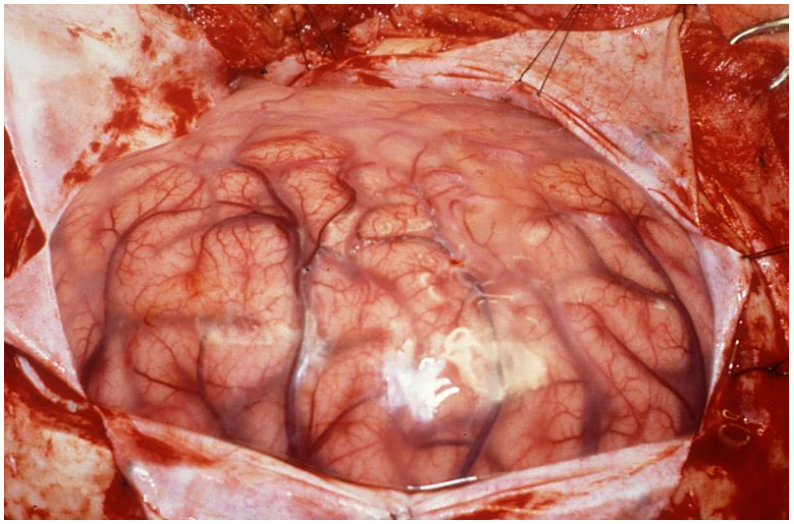


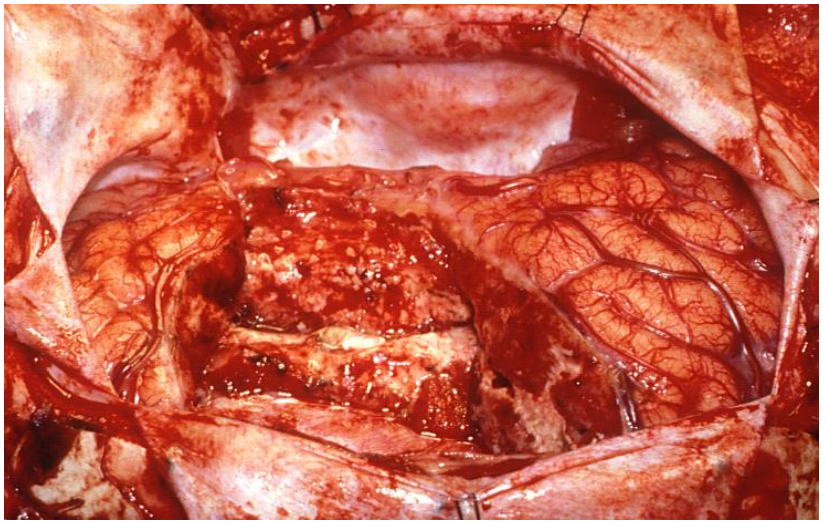
THE SOCIETY OF NEUROLOGICAL SURGEONS

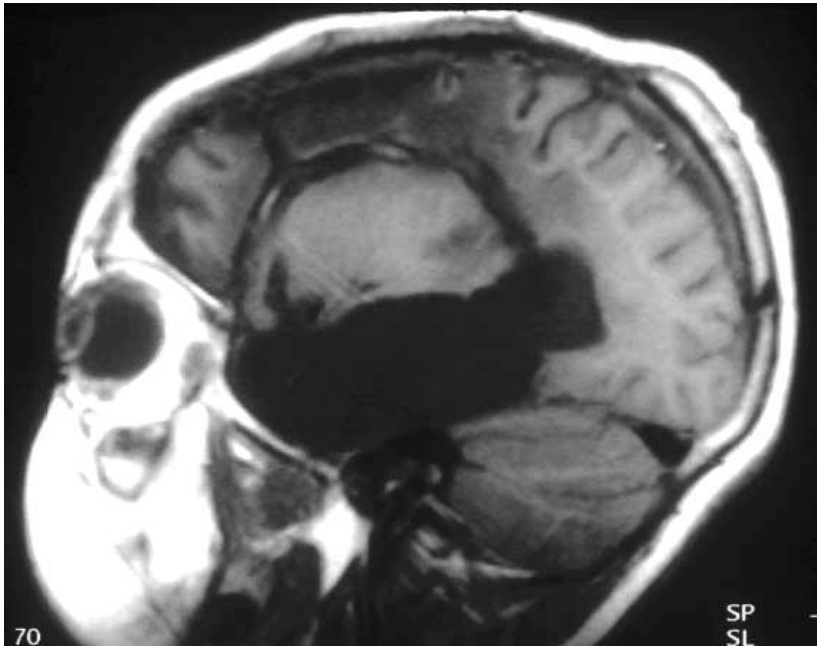
Hemispherectomy: Indications

- Sturge Weber
- Perinatal MCA stroke
- Hemimegalencephaly
- Rasmussen's encephalitis

Functional Hemispherectomy



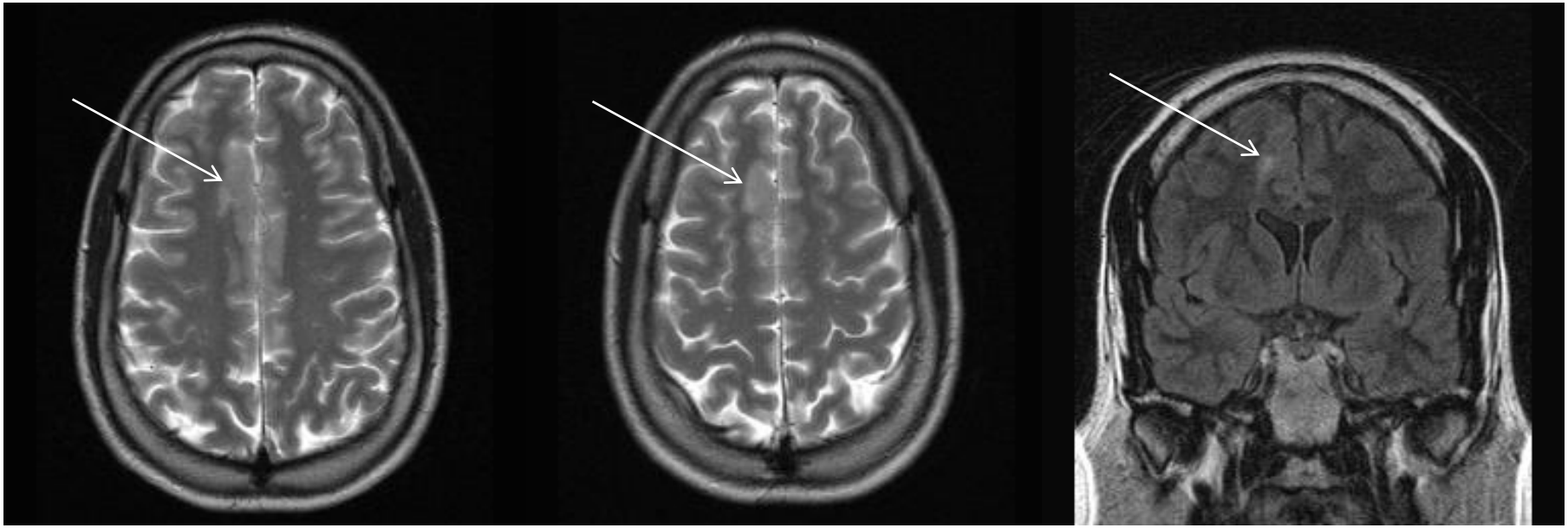


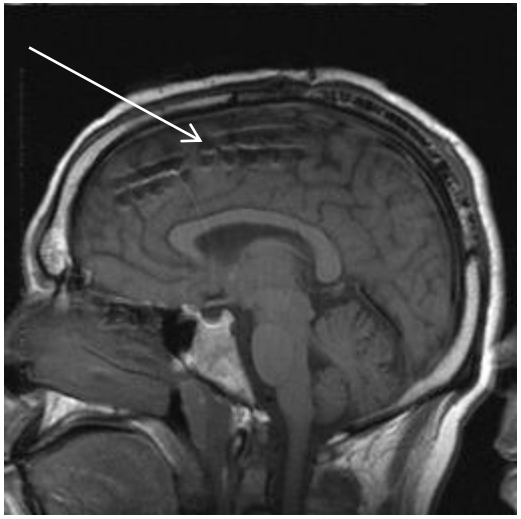


Case Illustration #1

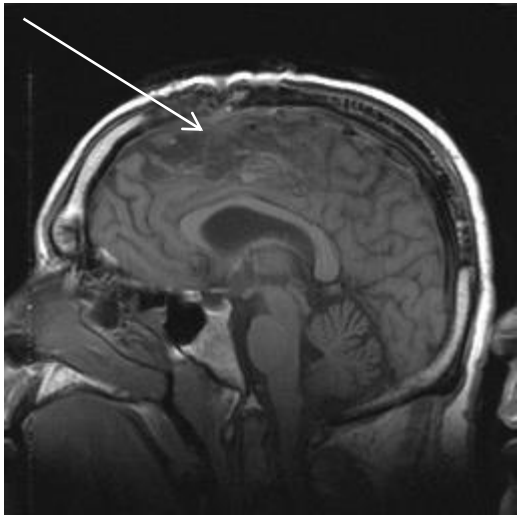
- 37 yo male
- Sz onset 7 yo
- Semiology: Supplementary Motor Area
- EEG right frontal
- Neuro exam: Normal

Case Illustration #1





Subdural Grids



Post-op

Pathology =
Cortical Dysplasia

Chronic Pain Conditions and Procedures

- Cranial neuralgias
  - Trigeminal neuralgia
  - Occipital neuralgia
  - Glossopharyngeal neuralgia
- Radicular leg pain without compressive cause
- Somatic cancer pain

Trigeminal Neuralgia

- Lancinating, excruciating episodic facial pain
- Carbamazepine first line agent
- Surgical procedures for medically intractable TN
  - Microvascular decompression(MVD):
    - Posterior fossa craniotomy to remove small vessels compressing the trigeminal nerve
    - First advocated by Dr. Peter Jannetta
    - Indicated for patients who can undergo craniotomy
  - Trigeminal rhizotomy: involves selective destruction of trigeminal nerve
    - Relieves pain but also creates numbness
    - Typically reserved for patients who aren't good candidates for craniotomy or MVD
    - Can be accomplished with thermocoagulation, glyceral injection, direct compressive injury with a balloon, or radiosurgery

Radicular Chronic Pain

- Pain typically resulting from radicular scarring or prior spinal surgery
- Can be done for upper and lower extremity pain
- Spinal cord stimulation may decrease extremity pain
  - Electrode “paddle” inserted typically epidural location
  - Wire connectors
  - Subcutaneous pulse generators

Conclusions

- Functional neurosurgery is a highly reward subspecialty of neurosurgery
- Functional procedures can significant improve patients lives
- While many neurosurgical procedures can be highly technical, functional procedures can be very highly technical in the interface with radiology, intraoperative navigation, intraoperative electrophysiology, and intraoperative mapping of neurological function