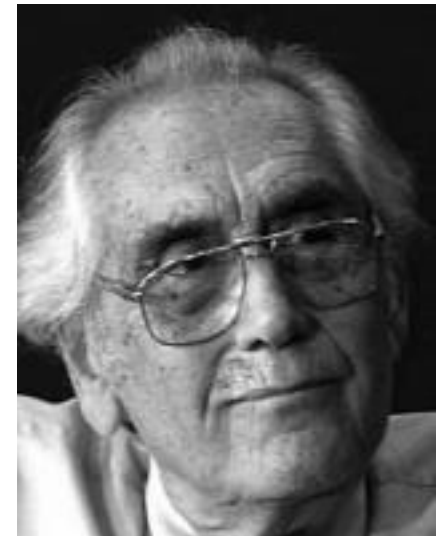


# Invasive EEG & SIEEG

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# SEEG

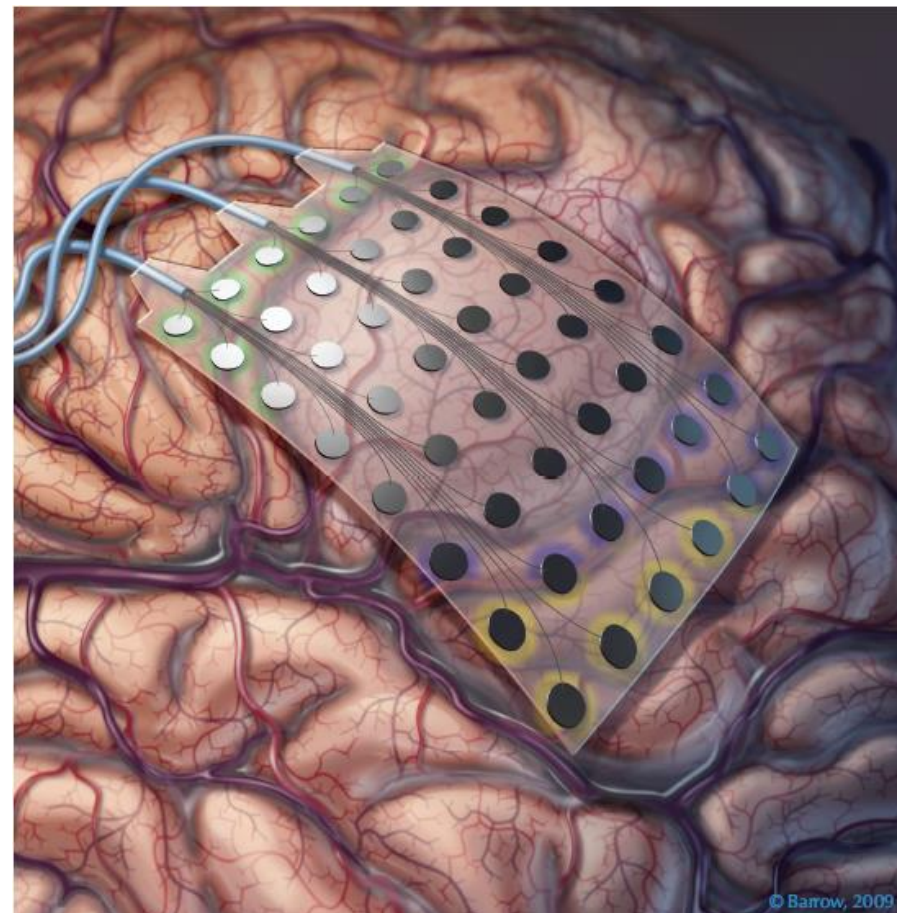
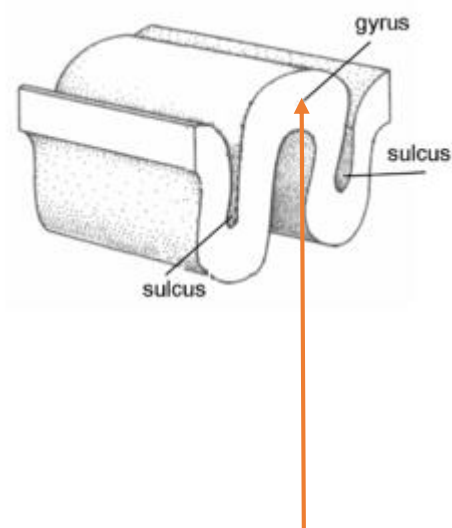
- Bancaud J & Talairach J.
- Sainte-Anne Hospital, Paris, France
- Second half of the 20<sup>th</sup> century



# Anatomo-electro-clinical correlations

- Spatio-temporal organization of the epileptic discharge within the brain
- Anatomo-electrical relationships
  - Temporal dynamic of ictal symptom with respect to the brain anatomy
- Electro-clinical relationships
  - Clinical picture must be evaluated as the discharges spread
  - Seizure pattern (identical clinical sign may result from the ictal disorganization of cortex regions)
- 3-dimensional arrangement

# Subdural electrode recordings



# Depth recordings

- Ensure the side of seizure onset in TLE
- Differentiated frontal lobe seizures from temporal lobe seizures

# Principle of SEEG methodology

- Hypothesis of the EZ localization
- Individualized “Custom-tailored”
- Adequate stereotactic Technique

# Epileptogenic zone

“The site of the beginning and of the primary organization of the epileptic seizures”

# Ictal onset

- Cortical area where the first clear ictal electrical change is recorded.
  - Prior to the clinical onset of seizure
  - Fast synchronizing discharge (low-voltage fast activity or recruiting fast discharge of spikes)



# Primary organization of the discharge

- The cortical area participating in early seizure spread
  - Spatial extent of discharges at the moment where the clinical sign(s) occurs
  - The coherence between the localization of the discharge and the type of concomitant symptom(s).
  - Cortex areas that are able to generate fast synchronizing discharge.

# Indications

- Drug resistant focal epilepsy
- Non-invasive investigations fail to correctly localize the epileptogenic zone

# Specific criteria for SEEG

- The possibility of a deep-seated or difficult-to-cover location of the epileptogenic zone (mesial structures of the temporal lobe, opercular areas, cingulate gyrus, interhemispheric regions, posterior orbitofrontal areas, insula, and depth of sulci)
- Failure of a previous subdural invasive study to clearly outline the exact location of the seizure-onset zone
- The need of extensive bihemispheric explorations (multilobar or bihemispheric lesions)
- A presurgical evaluation suggestive of functional network involvement (e.g. limbic system) in the setting of normal MRI

# Requirement

- Epileptologist who can understand the methodology and knows how to read SEEG recordings/EMU
- MRI
- Angio Image (CTA, Angiogram)
- Stereotactic device (Frame, ,Frameless, Robot)
- Fluoroscopy

# PNI workflow for SEEG procedures

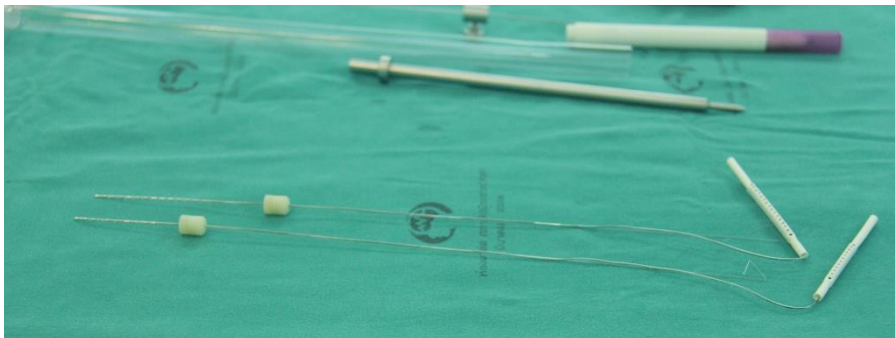
- MRI & contrast
- CTA, CTV
- Stereotactic frame placement
- Planning

# Equipments

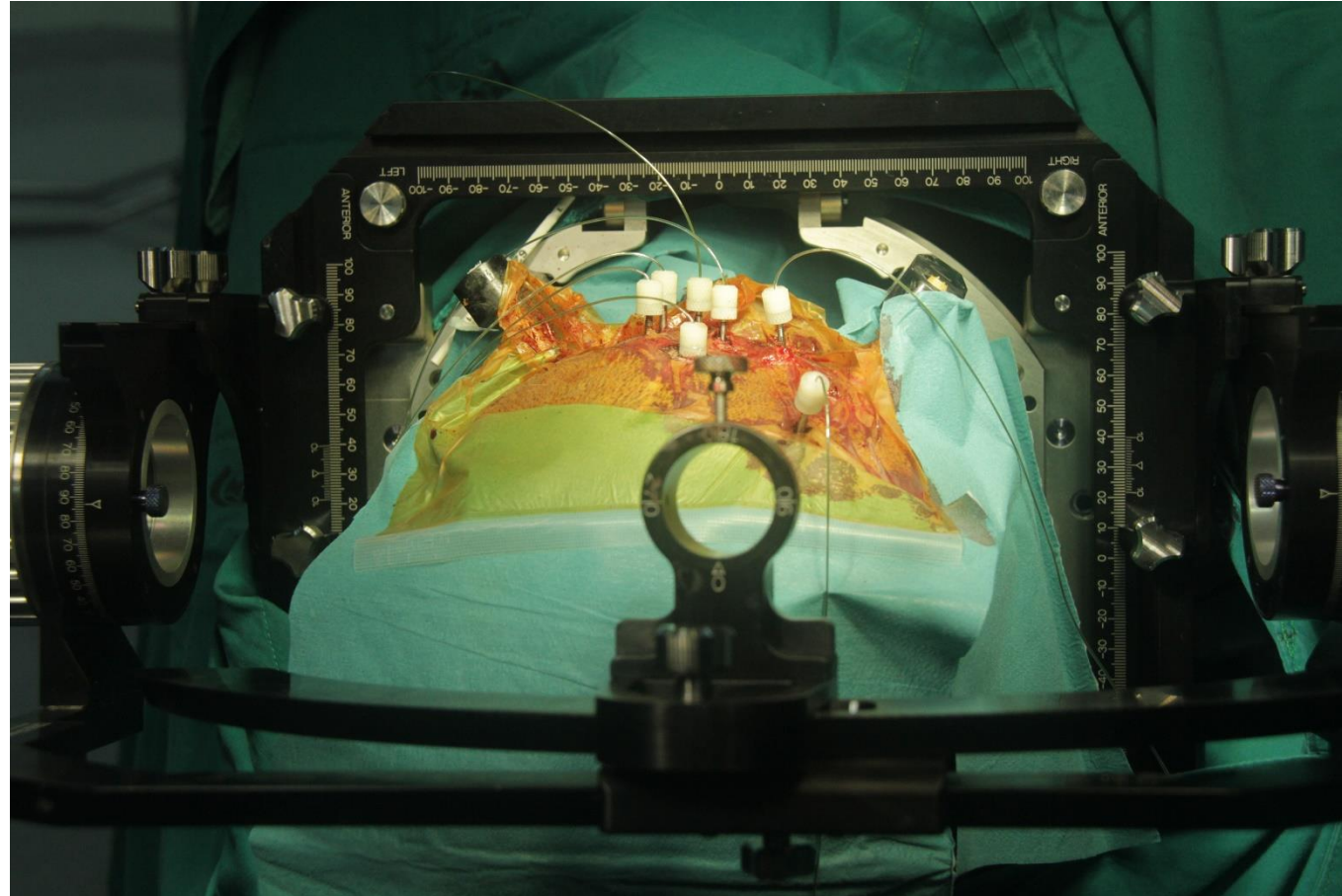
- Skin probe
- Dura Probe
- Ruler
- Screw drivers
- Stylet
- Drill and Bit

Gonzalez-Martinez J. J Neurosurg 2014; 12:639-644.

# Prasat Neurological Epilepsy Centre

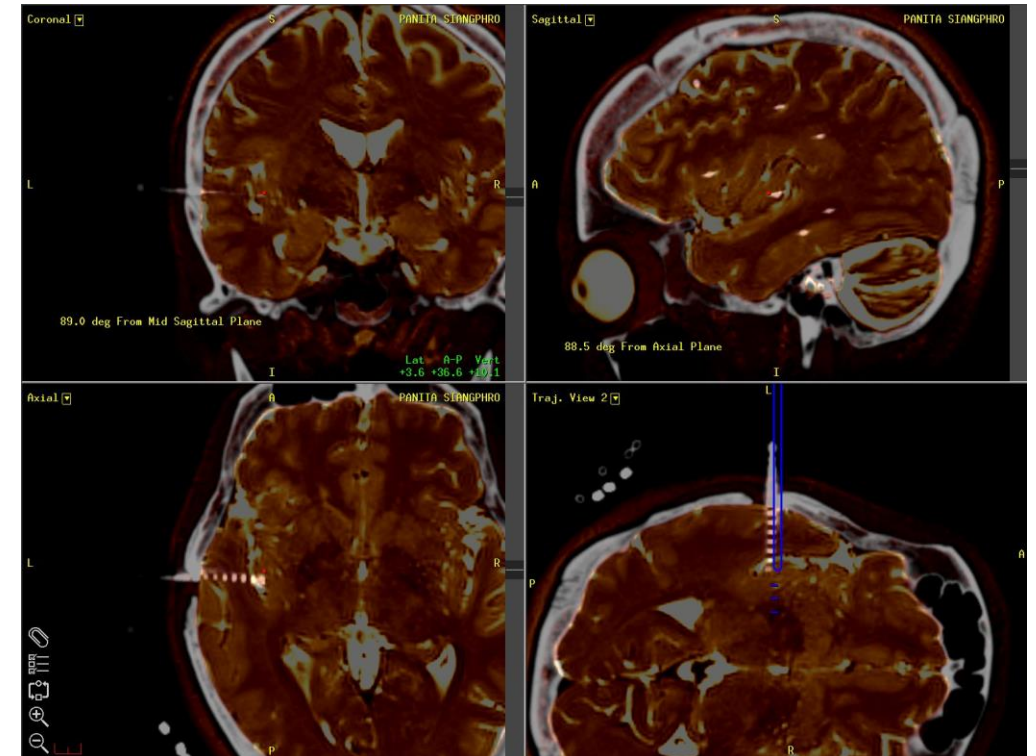
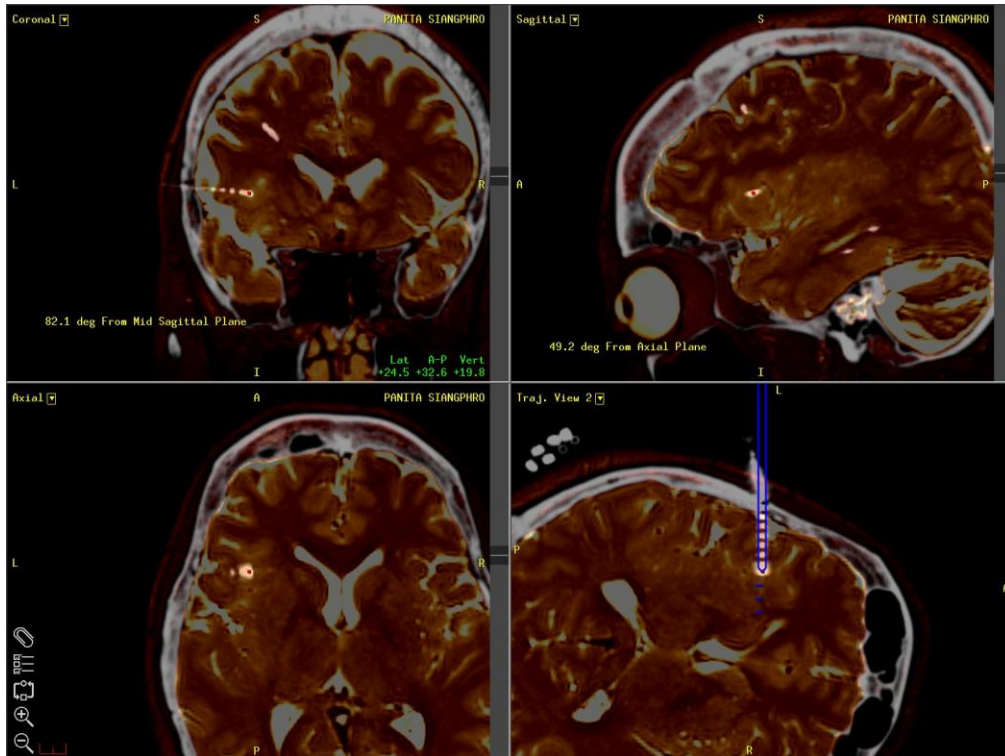


# SEEG

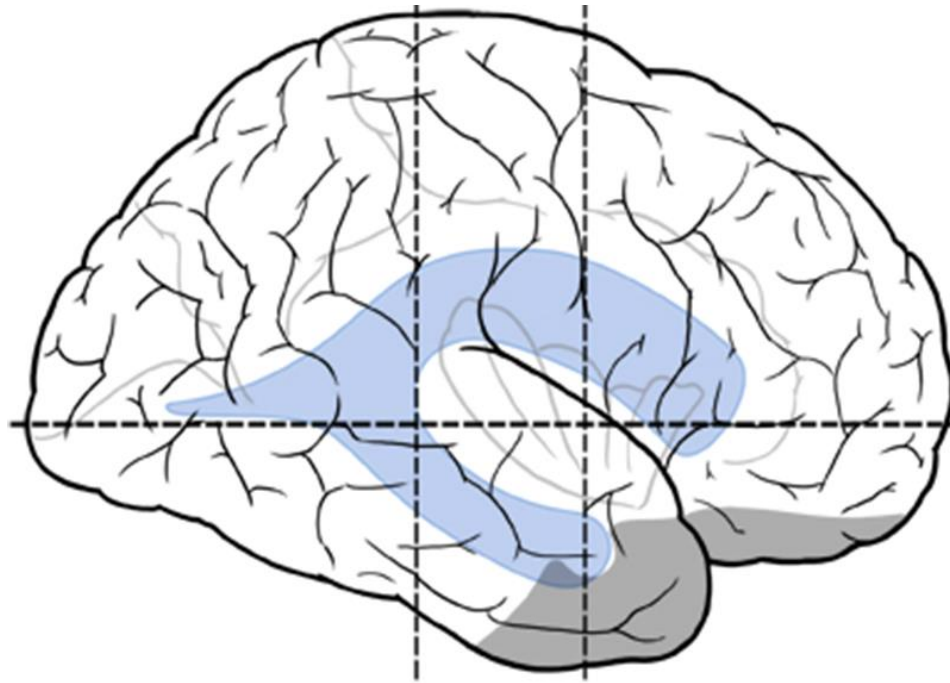




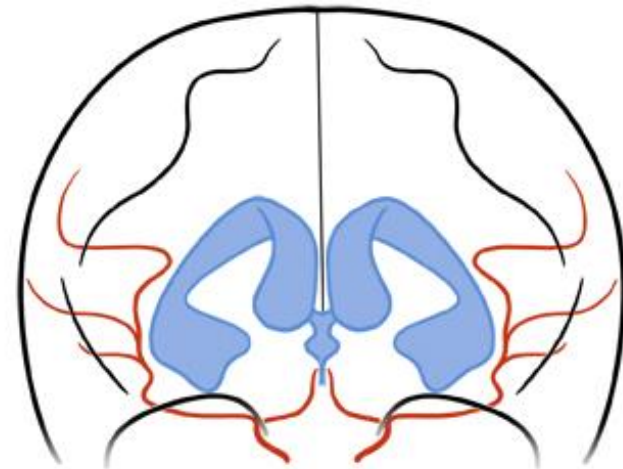
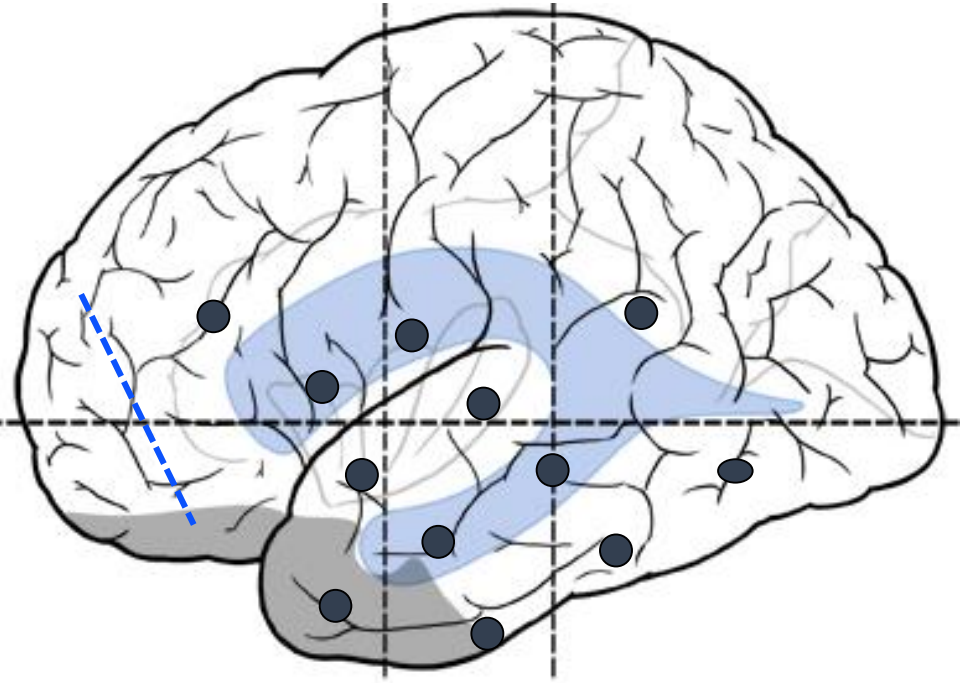
# Post op CT fused with pre-op MRI



RIGHT



LEFT



# How to define the extent of resection?

“Subdural method does not apply for SEEG resection”

- Anatomico-electro-clinical correlation
- Up to the non-involved electrode
- Up to eloquent cortex (will need functional mapping)
- Cytoarchitectonic area, Functional anatomy
- Surgeons judgement (risks vs benefits).

# SEEG

- 122 patients (March 2009-April 2012)
- M 65, F 57 (21 pediatric patients)
- Time for planning 33 mins (20-47 mins)
- Time for implantation 107 mins (47-150 mins)
- Complication per electrode 0.18%
- Hypothetical epileptogenic zone was localize in 115 patients (94%)
- Seizure-free 62% (@12 months)

Gonzalez-Martinez J. J Neurosurg 2014; 12:639-644.

# SEEG following SDE

- 14 patients who had previous SDE evaluation
  - 10 (71%) underwent a resection after SEEG
  - 4 (29%) not undergo resection, 2 eloquent cortex, 1 bitemporal epilepsy, 1 previous TL contralateral to the EZ
- 7 pts nonlocalizable ictal onset from SDE => 6 had hypothetical EZ localized after SEEG (deep or difficult-to access cortical regions)
- 7 pts misleading ictal patterns => inadequate/incomplete resections
- 60% seizure free at 11 months

# Morbidity

- SEEG
  - Low
  - Mainly intracerebral bleeding
  - Permanent neurological deficit <1%
    - (Gonzalez J, 2013) complication rate 3% (0.2%/implanted electrode)
    - (Cossu et al. 2005) morbidity 5.6%, permanent deficits 1%

Thank you