# FACULTY/PRESENTER

FACULTY

BORIS BERNHARDT

RELATIONSHIP WITH COMMERCIAL INTERESTS

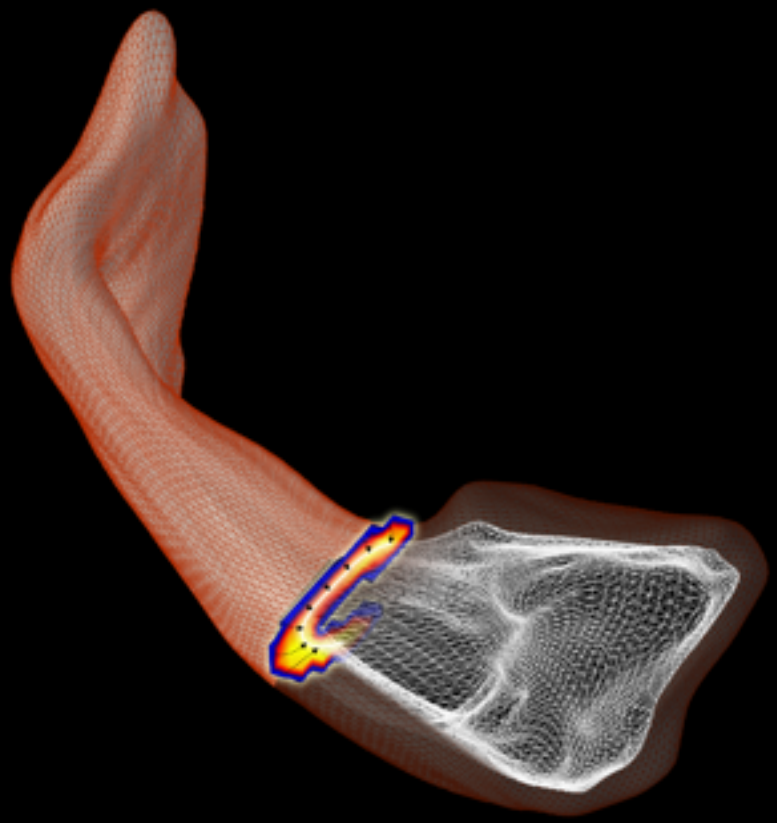
NONE

# DISCLOSURES

NO CONFLICTS OF INTEREST

# MITGATING POTENTIAL BIAS

NO COMMERCIAL BIAS



# STRUCTURE FUNCTION ANALYSIS ALONG HIPPOCAMPAL SUBFIELD SURFACES IN TEMPORAL LOBE EPILEPSY

Boris Bernhardt, PhD

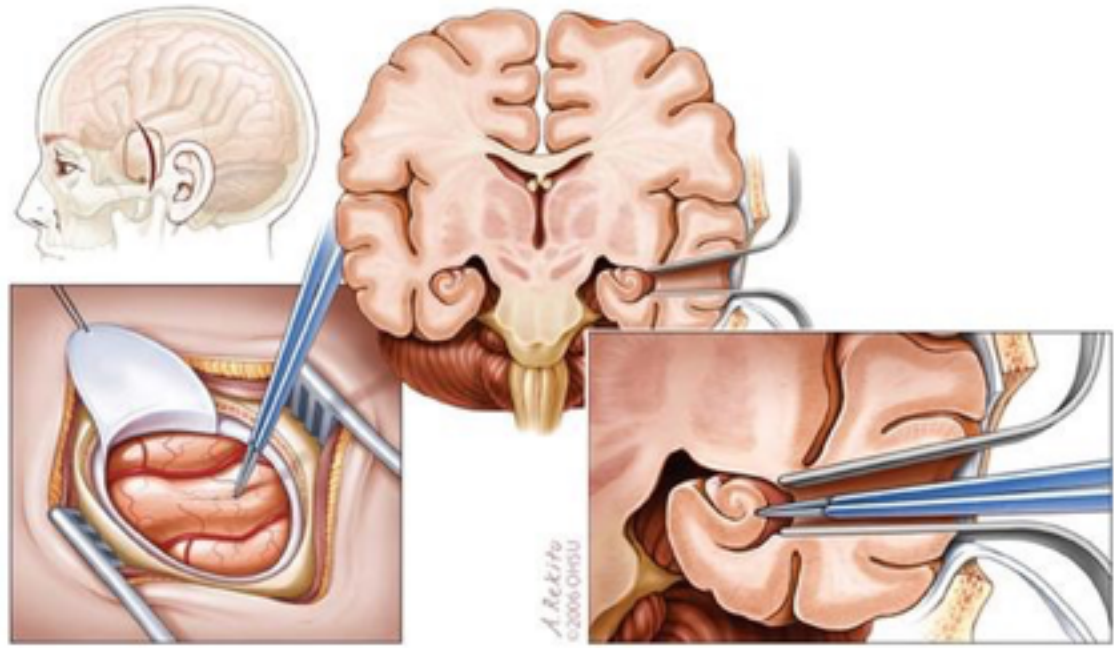
http://mica-mni.github.io

# TEMPORAL LOBE EPILEPSY

MOST COMMON DRUG-RESISTANT EPILEPSY IN ADULTS

SEIZURES ARISING FROM TL

SURGERY MOST EFFECTIVE TREATMENT

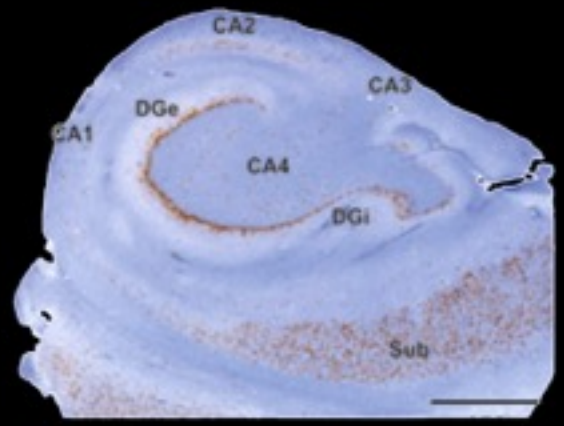


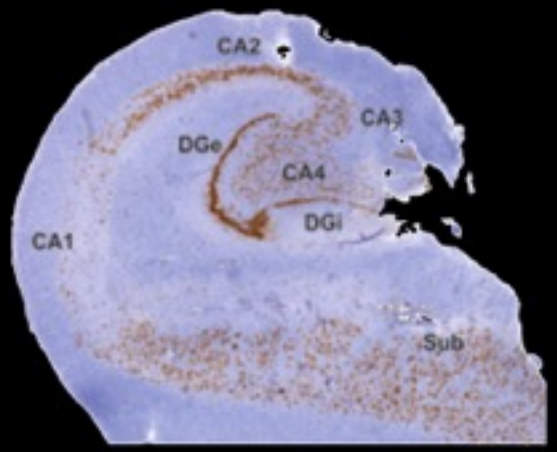
Spencer & Burchiel (2012) Epilepsy Research and Treatment

# TEMPORAL LOBE EPILEPSY

Pathological hallmark: hippocampal sclerosis (HS) – not a single entity

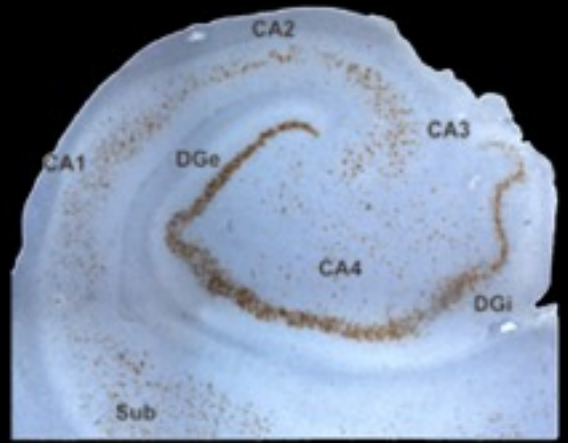
CA1+CA4 cell loss + gliosis

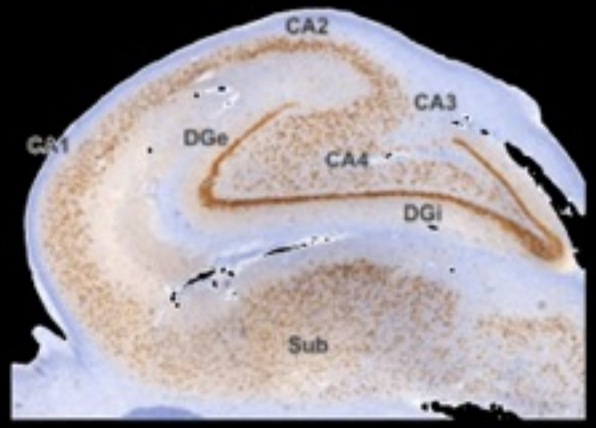



CA1 cell loss + gliosis

CA4 cell loss + gliosis




gliosis only

Blümcke et al (2013) Epilepsia

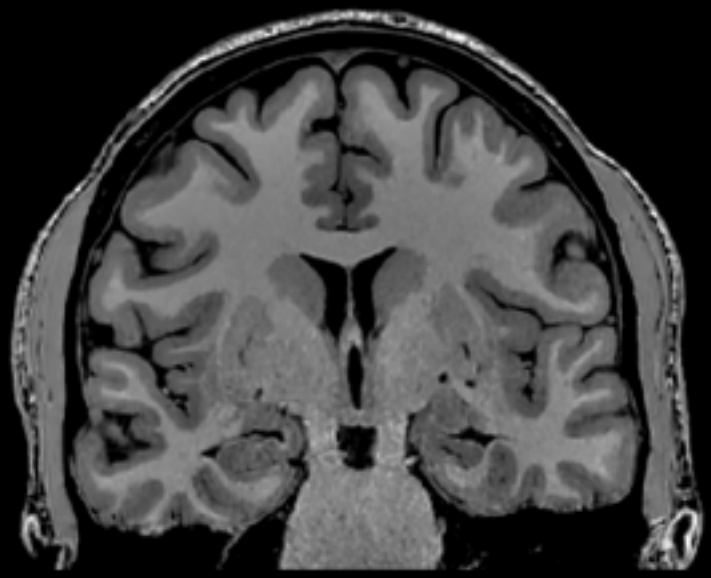
# HIPPOCAMPAL PATHOLOGY AND IMAGING IN TLE

MRI plays key role in detecting HS non-invasively

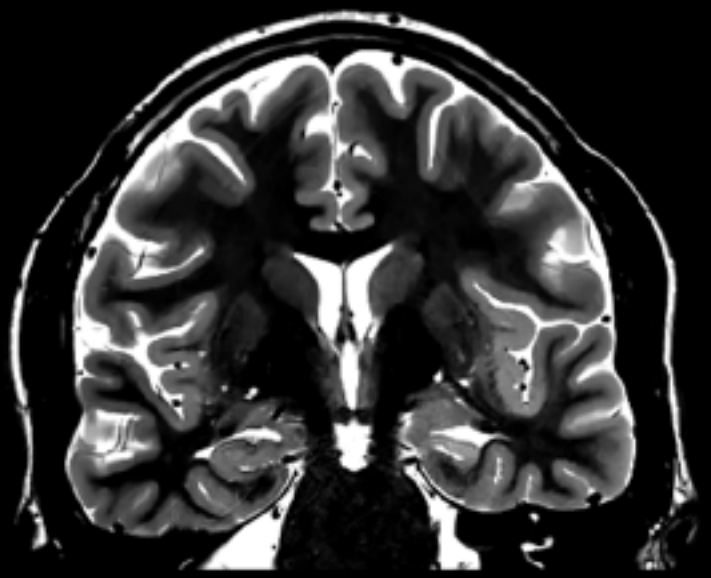
Atrophy and T2w increases can lateralize seizure focus in patients with HS

In the clinics: most frequently done visually

Increasing proportions of patients with less remarkable anomalies



T1-weighted



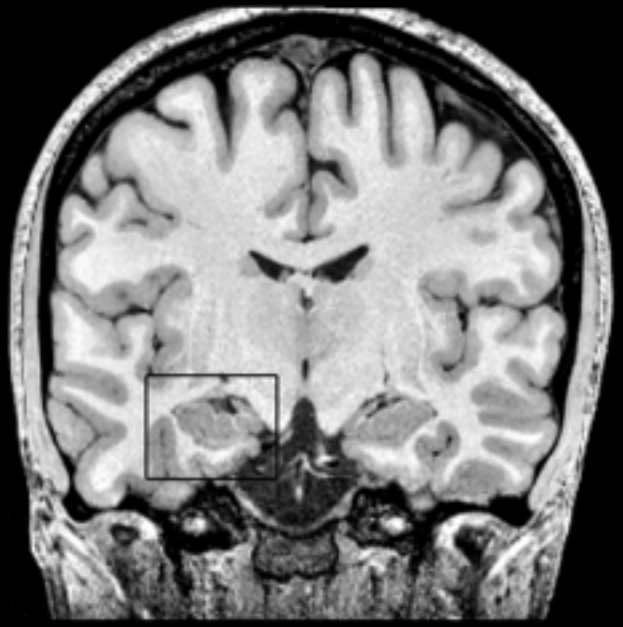
T2-weighted

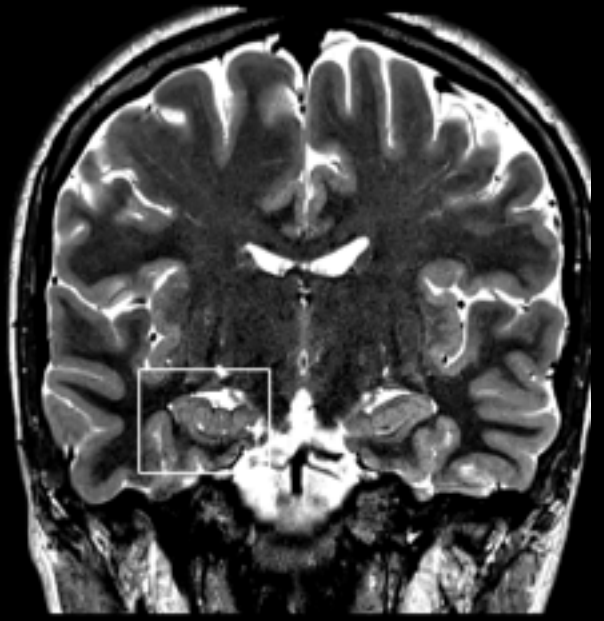
# STUDY PURPOSE

IDENTIFY MRI SIGNATURES OF TLE-HS AND TLE-G

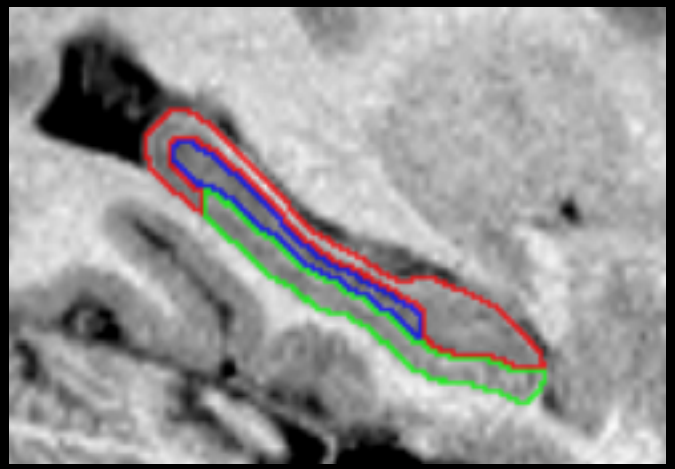
DESIGN:

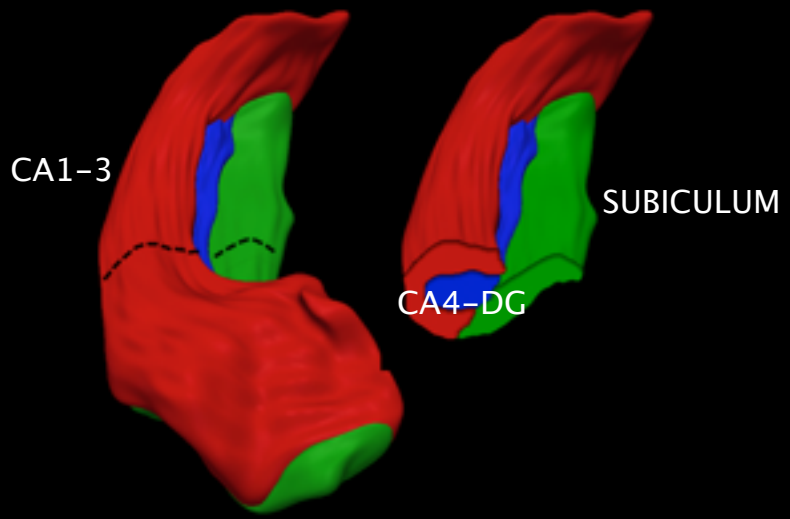
- Consecutive series of 39 unilateral TLE patients who had high resolution preoperative MRI, no mass lesions, surgical treatment, and ILAE HS scoring
  - 20 TLE-HS (10 HS-1, 6 HS-2, 4 HS-3), 19 TLE-G
  - 25 age- and sex-matched controls
- Multi-modal 3T MRI in all, in addition to clinical imaging
  - high-resolution T1w (0.6 mm, 2 averages), T2w (0.4×0.4×2.0 mm)
  - standard DWI and RS-FMRI
- Hippocampal subfield segmentations in all





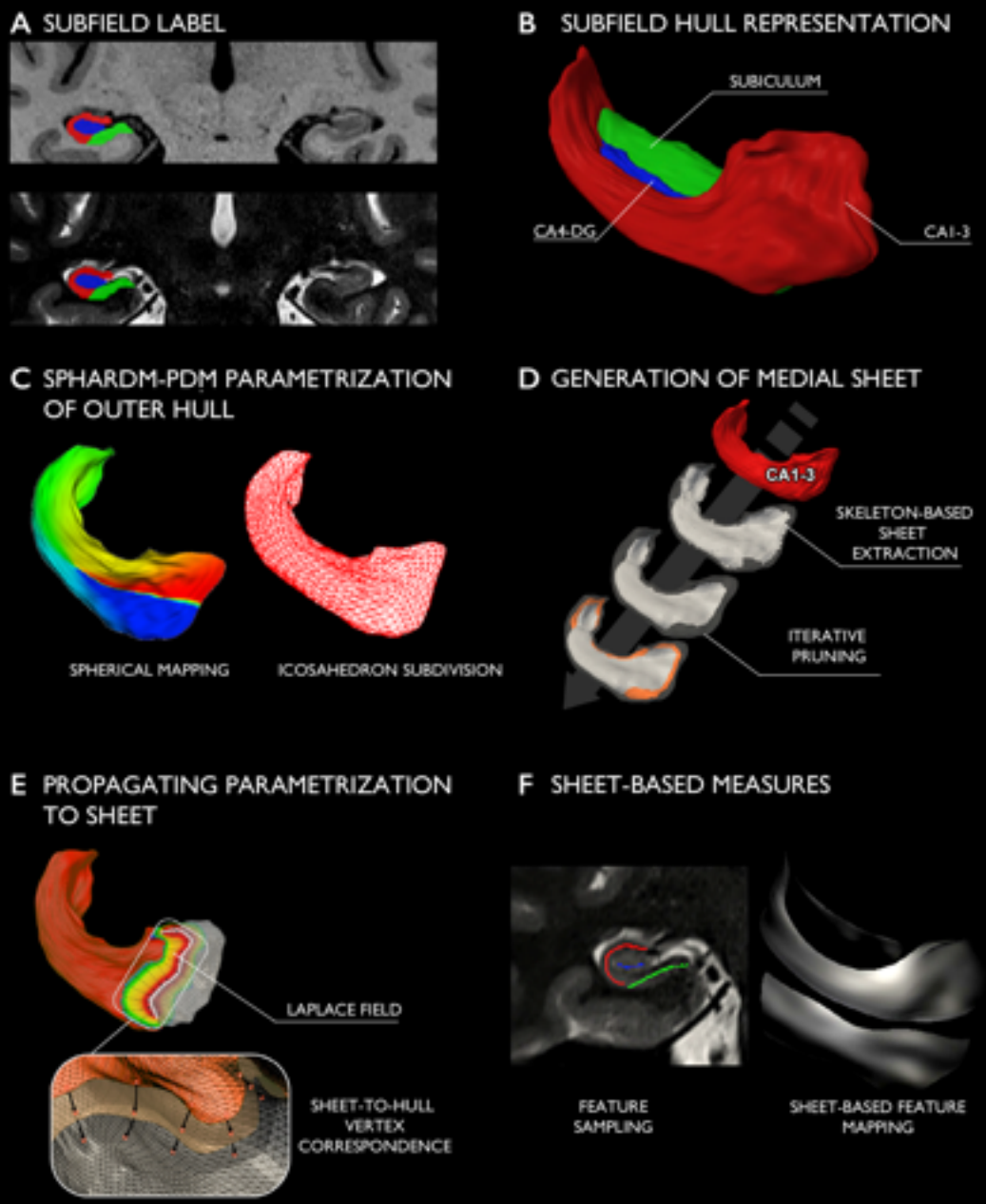
https://www.nitrc.org/projects/mni-hisub25/





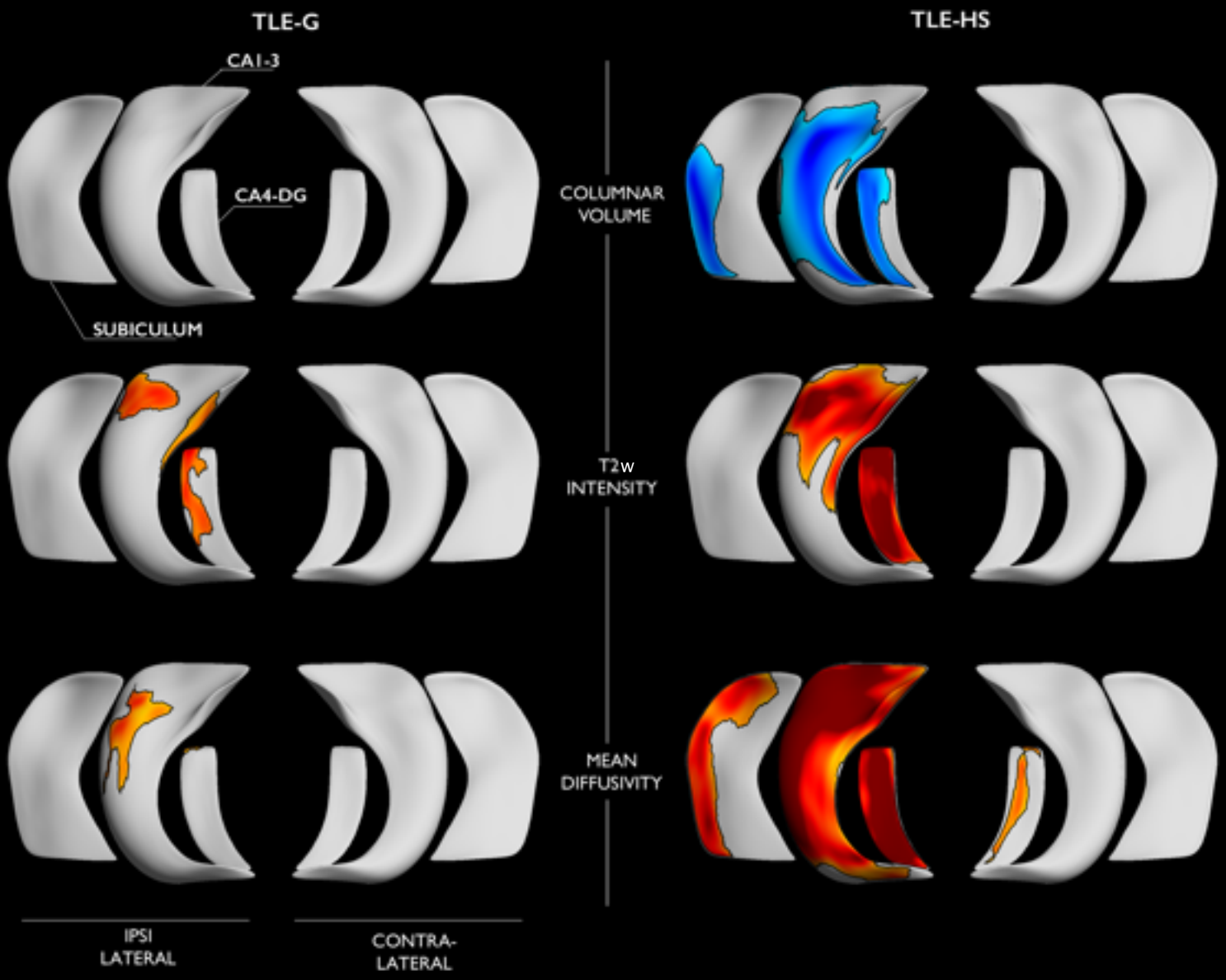

Kulaga -Yoskovitz et al. (2015) Scientific Data

# IMAGE PROCESSING



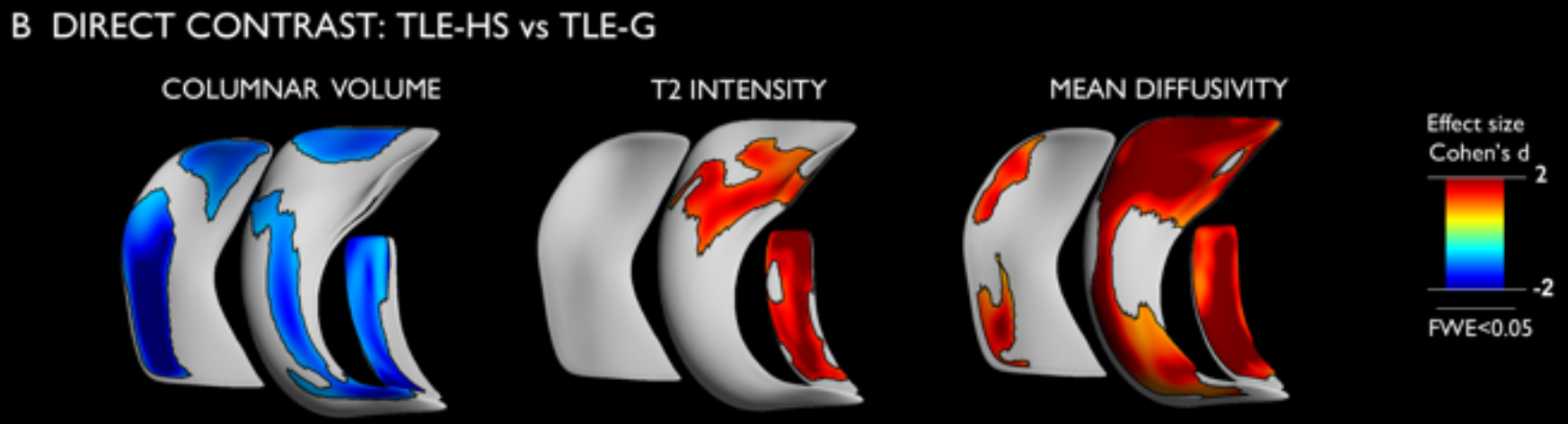

Kim et al (2015) MICCAI

# FEATURE-SPECIFIC COMPARISON TO CONTROLS

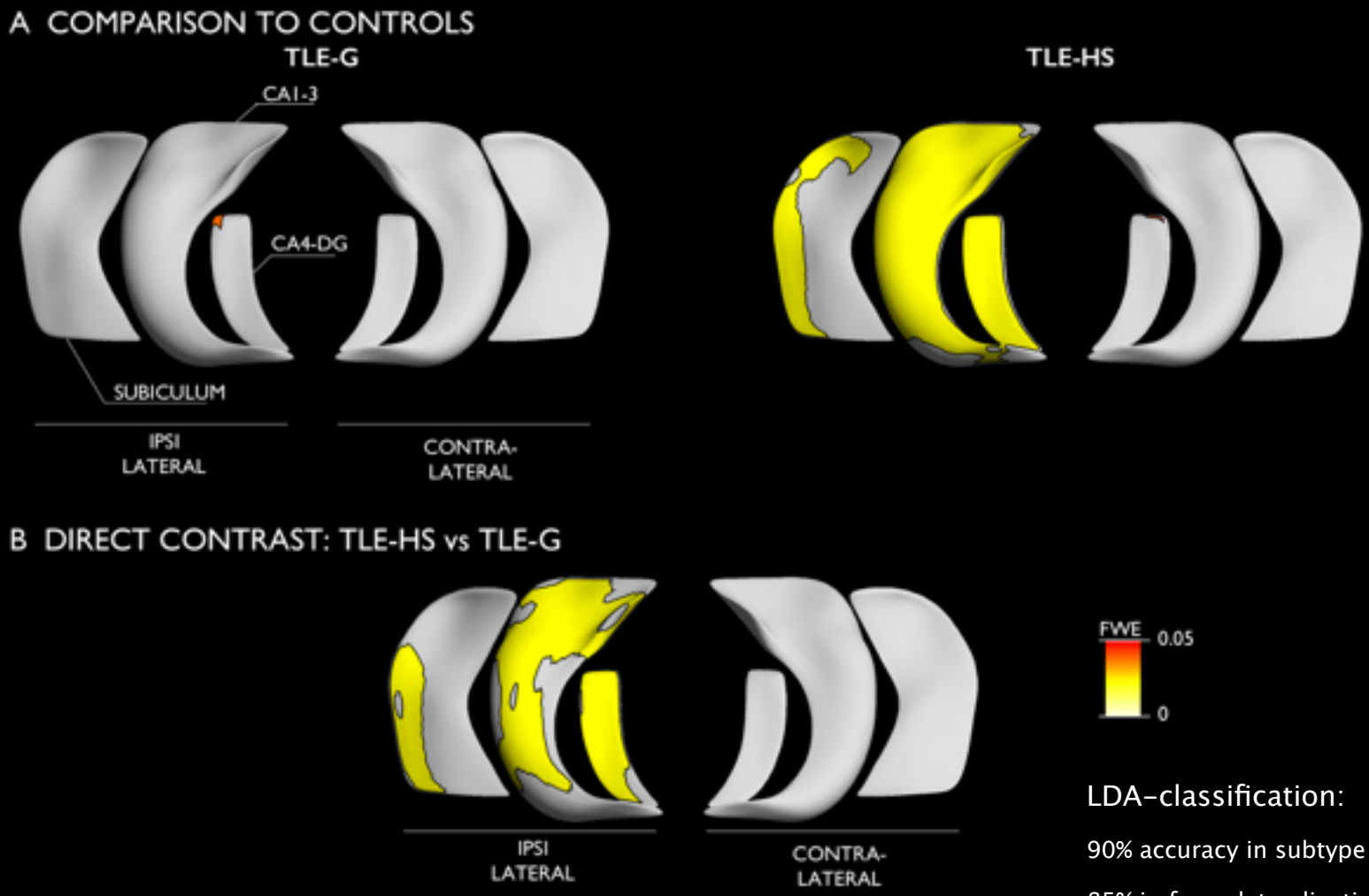



Bernhardt et al (2016) Annals of Neurology

# DIRECT CONTRASTS



# MULTIVARIATE SYNTHESIS




LDA-classification:

90% accuracy in subtype discrimination

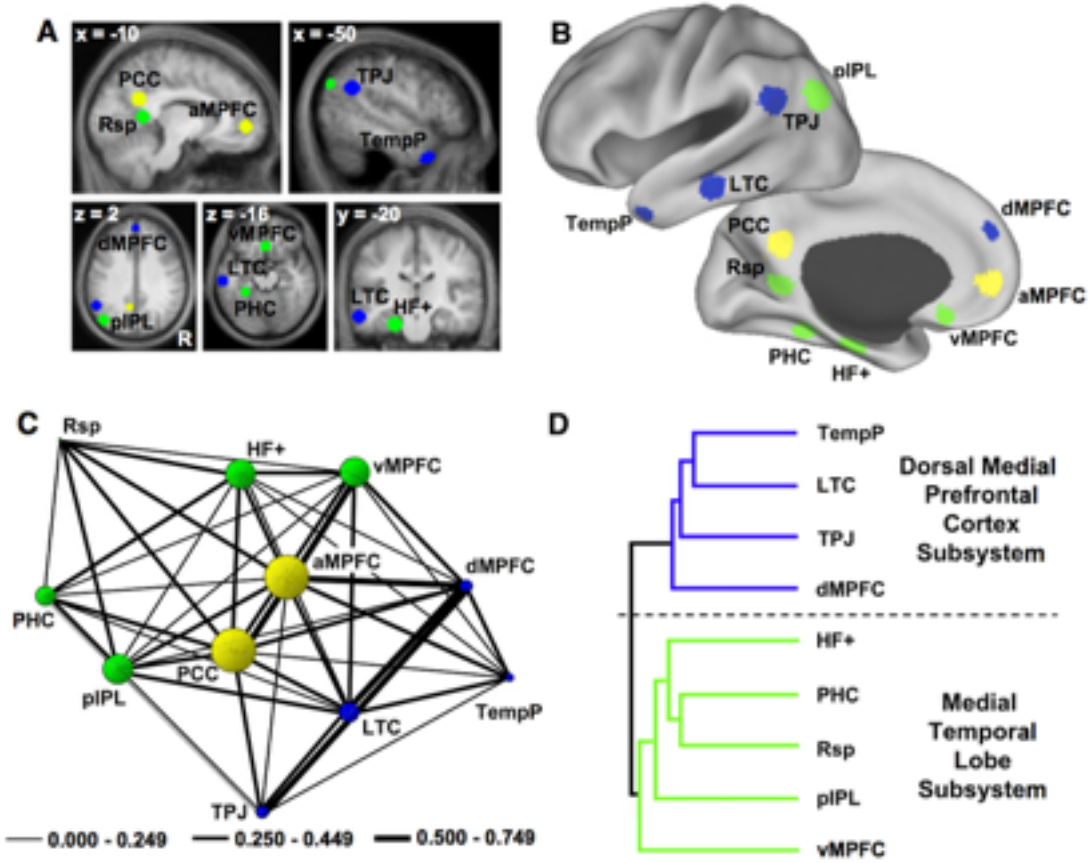
85% in focus lateralization

# FUNCTION

RESTING-STATE FMRI ANALYSIS
PROVIDE INFORMATION ON
INTRINSIC FUNCTIONAL NETWORKS

HIPPOCAMPUS HIGHLY INTEGRATED
WITH DMN

TLE-HS vs TLE-G:
DISEASE MODEL TO PROBE
STRUCTURE-FUNCTION RELATIONS




Andrews-Hanna et al (2010) Neuron

# FUNCTION

rs-FMRI ANALYSIS
PROVIDE INFORMATION ON
INTRINSIC FUNCTIONAL NETWORKS

HIPPOCAMPUS HIGHLY INTEGRATED
WITH DMN

TLE-HS vs TLE-G:
DISEASE MODEL TO PROBE
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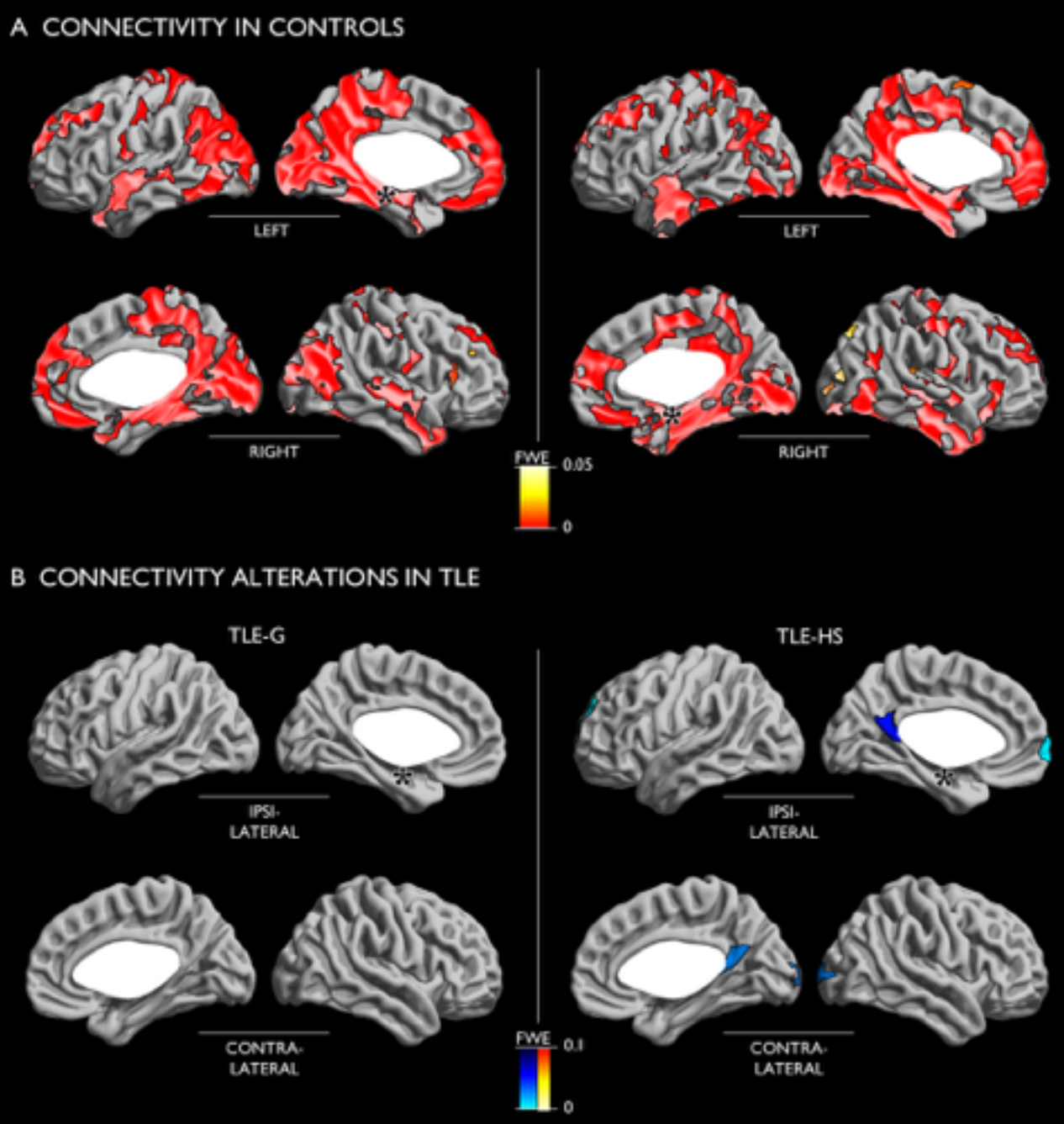
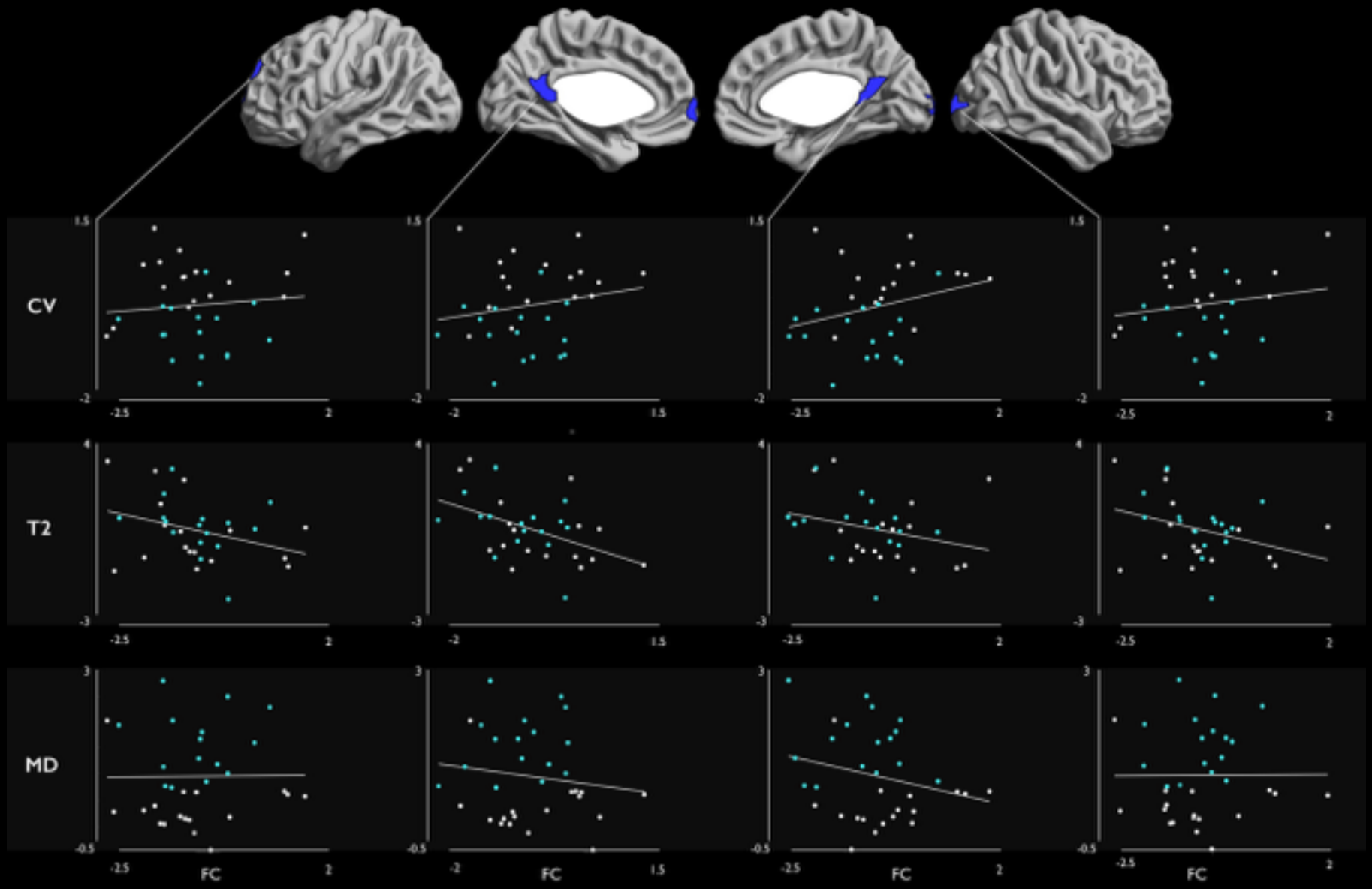



Bernhardt et al (2016) Annals of Neurology

# STRUCTURE FUNCTION RELATIONSHIPS IN TLE



# SUMMARY

MRI can probe and predict histopathology

Dissociation between pathologically defined patient subgroups at the level of

- Structural profiles
- Functional embedding within DMN

Degree of structural anomalies relates to functional network markers

Neuroimaging of Epilepsy Lab

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Terry Peters