



Spatio-temporal evolution of network connectivity from the seizure focus in TLE

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We measured MRI network progression in mesial temporal lobe epilepsy (mTLE) patients as a function of healthy brain architecture.

Subjects: 40 mTLE (29 right, 11 left) + 70 healthy controls

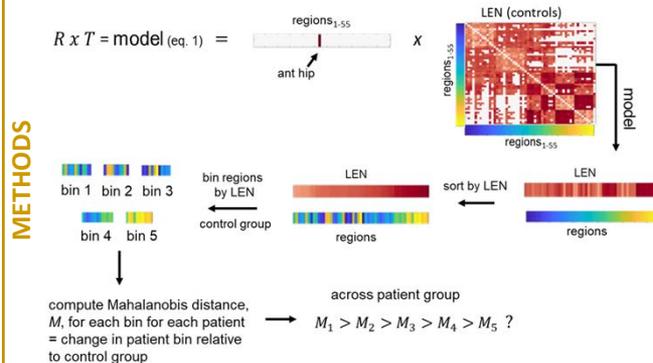
Models of distance in the healthy brain from anterior hippocampus (presumed seizure focus) was computed using 4 topologies (T) computed across controls:

- Functional connectivity (FC)
- Structural connectivity (SC)
- Streamline length (LEN)
- Resting-state network (RSN) based on gradient of transmodal (higher cognitive function) to unimodal (perceptual) networks

Hippocampal network was defined for each region (R) as its connection to the anterior hippocampus.

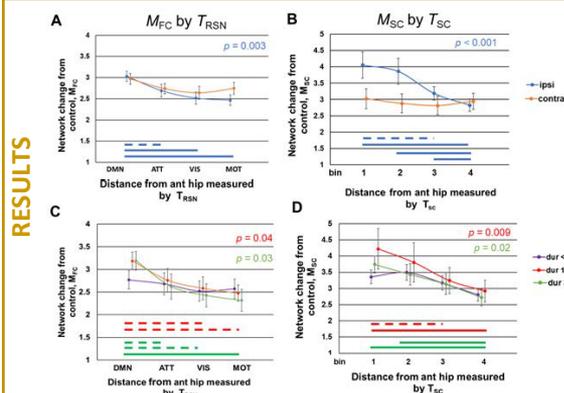
Question: Is a region's hippocampal network change in mTLE related to its distance from the anterior hippocampus (FC, SC, or LEN) or along the functional gradient (RSN) in healthy brain? i.e. **Do regions closer to the seizure focus have greater network alterations over time than those farther away?**

NIH NS075270, NS108445, NS110130, NS097618, NS112252



Analysis of hippocampal network change

Analysis process using streamline length (LEN) as the topology, T , and the anterior hippocampus (seizure focus) as the region, R , to develop a model of distance from R in the healthy brain. The model vector of LEN values is sorted and binned. The Mahalanobis distance is then computed for edges in each bin to quantify the patient's change from the population of healthy controls. The hypothesis is that the Mahalanobis distance for the "closest" bin (bin 1, shortest LEN) will be highest, with decreasing values for bins of increasing LEN.



Hippocampal network change related to healthy topology

The hippocampal functional network alterations in mTLE (M_{FC}) occurred across an organization of the brain related to inclusion in functional resting state network (T_{RSN}) ranked by transmodal to unimodal gradients (**A**). Structural connectivity alterations in mTLE (M_{SC}) occurred as a function of distance to the anterior hippocampus in the healthy brain measured by structural connectivity (T_{SC}) (**B**). Moreover, this effect was more pronounced in patients in the second and third decade of disease (**C and D**). All effects ipsilateral to seizure focus only.

Widespread network changes in mTLE occur along specific pathways that can be predicted by healthy brain architecture.