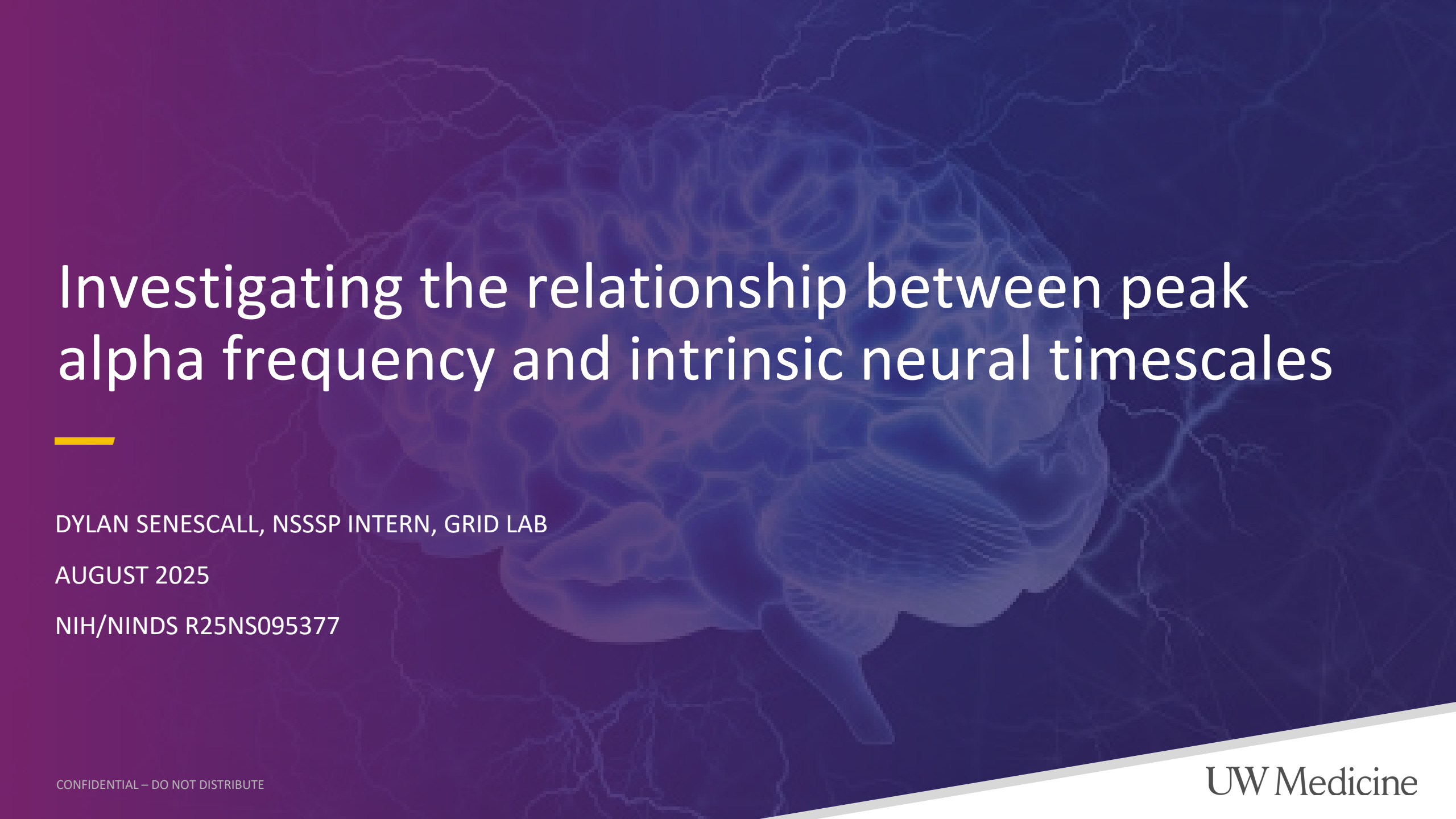




Investigating the relationship between peak alpha frequency and intrinsic neural timescales

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Developmental Neurophysiology

What is it?

- How the brain's functional properties change as it matures

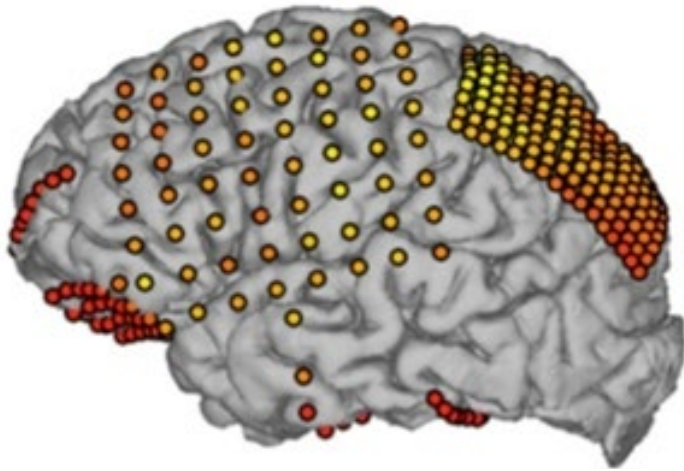
Why should we study it?

- Better understanding of typical human functioning and development
- Uncovering mechanisms of dysfunction in complex behaviors (ex. neurodevelopmental disorders)



Source: *Neurophysiology*. (n.d.). Department of Physiology. Retrieved August 11, 2025, from <https://www.mcgill.ca/physiology/research/neurophysiology>

Methodology



Approach. (n.d.). Parvizi Lab. Retrieved August 13, 2025, from <https://med.stanford.edu/parvizi-lab/approach.html>

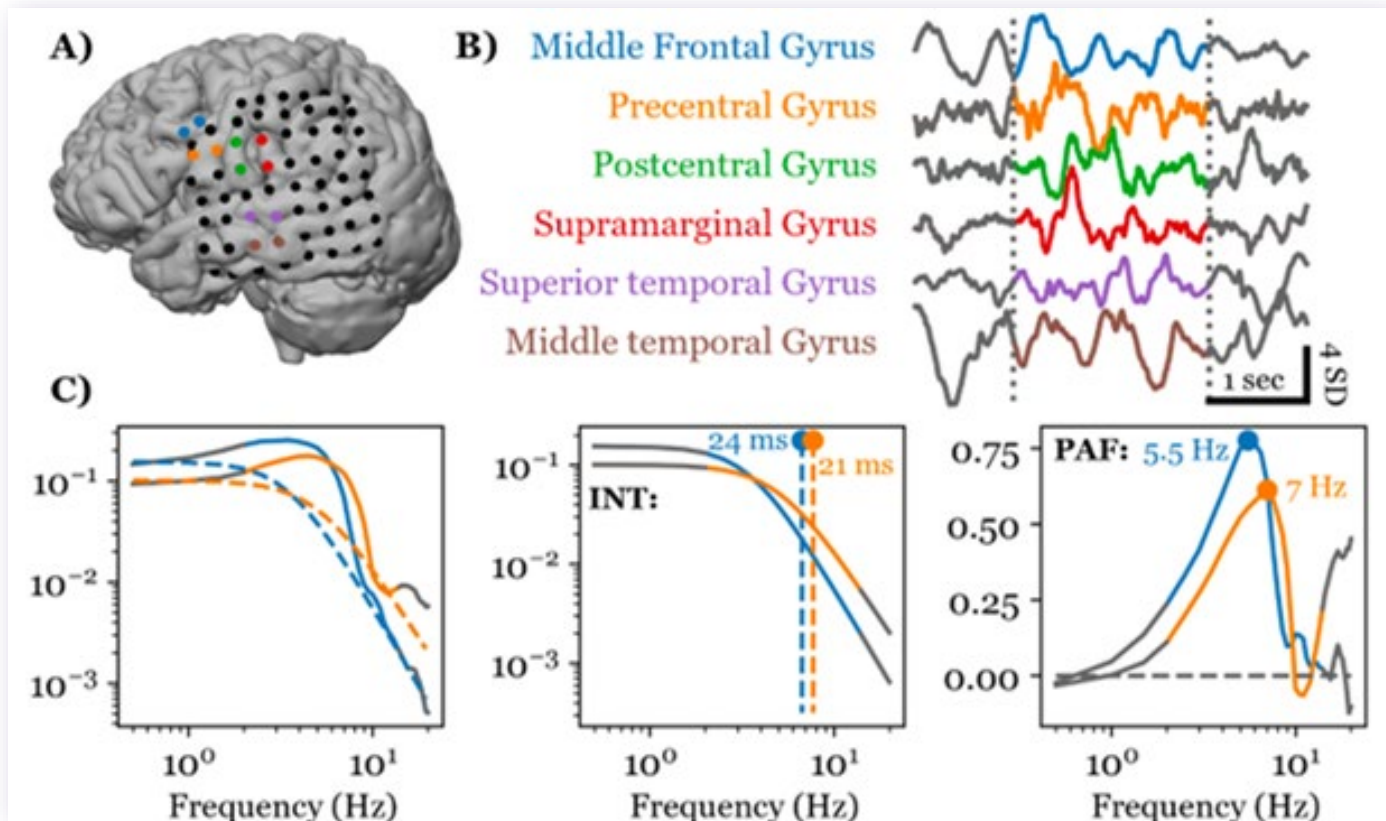
Electrocorticography (ECoG)

- In treatment-resistant epilepsy patients in Epilepsy Monitoring Units (Harborview Medical Center & Seattle Children's)
- n = 13, aged 3 to 33
- Resting-state recording (~3-6 minutes)
- 6 recording sites across cortical surface
- Sampling rate between 500-4000 Hz depending on hardware

Data Analysis:

Peak Alpha Frequency (PAF) and Intrinsic Neural Timescale (INT)

PAF & INT from ECoG reading



Miles, J. et al (2025). Developmental relationships between the human alpha rhythm and intrinsic neural timescales are dependent on neural hierarchy [Unpublished manuscript].

Important terminology

Power spectrum:

- Graph displaying frequencies and their power (prominence in the overall signal)

INT:

- How long a brain region holds onto information before resetting (long timescales = region holds on longer)
- Calculated from overall shape of power spectrum

PAF:

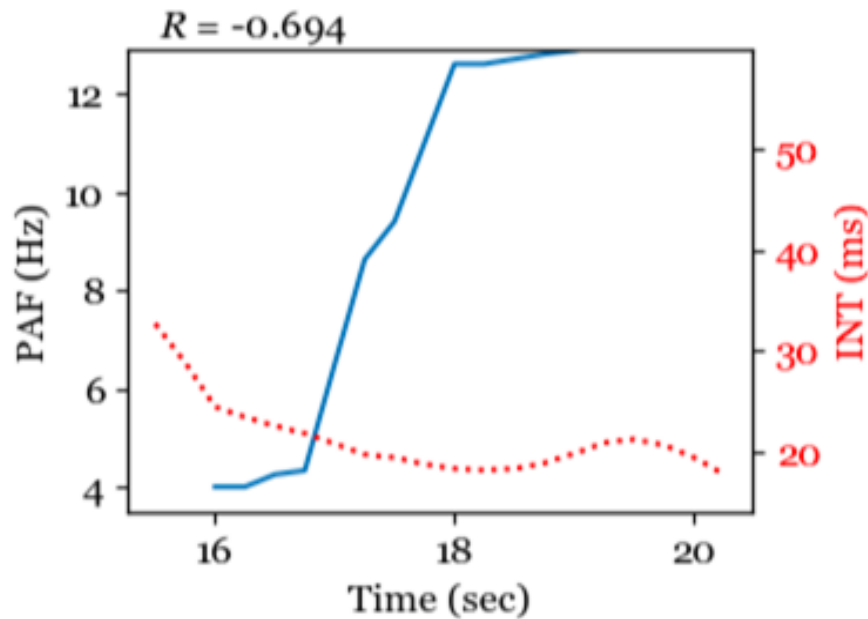
- Frequency in alpha range with highest power
- Calculated from peak in power spectrum

Generating Questions/Hypotheses

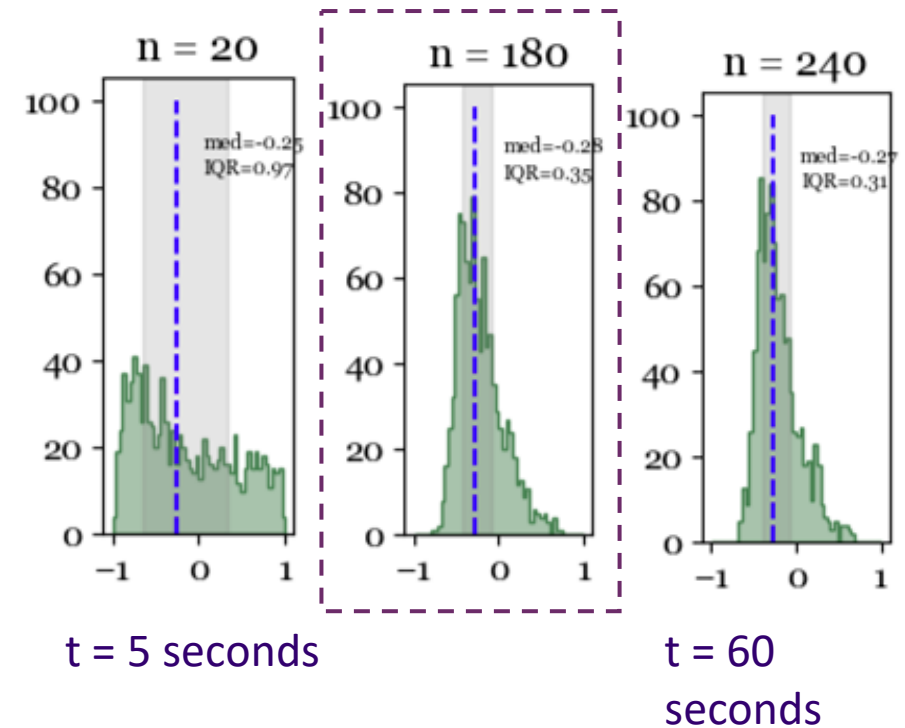
1. Are these measures correlated (over a short timespan)?
1. Does brain region type, age, or individual differences describe the distribution patterns?

1. Are these measures correlated?

Correlation between PAF & INT



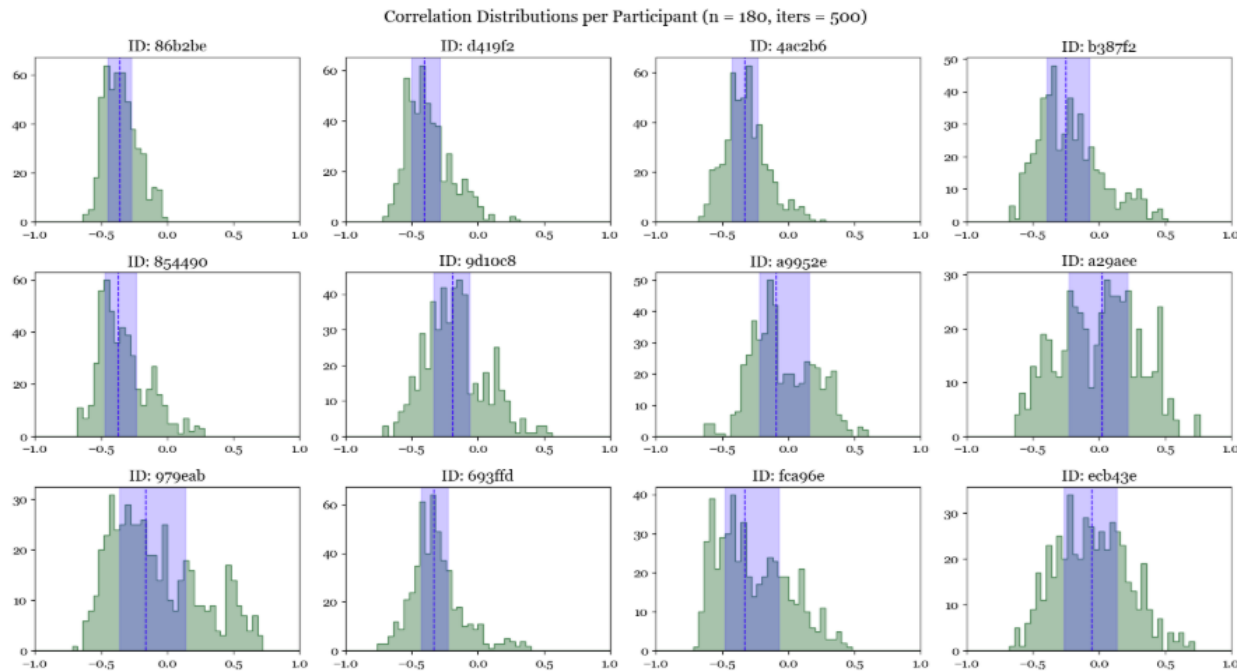
PAF & INT from ECoG reading



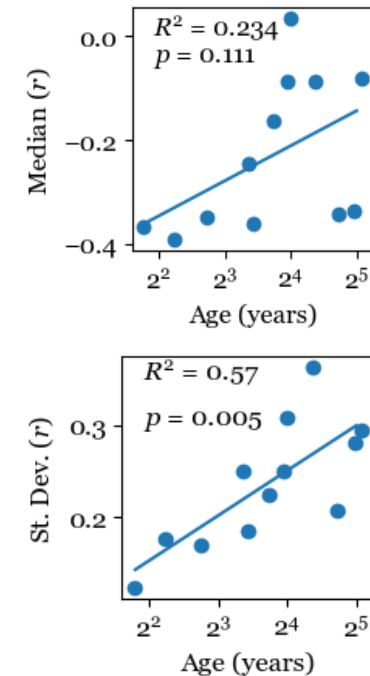
Over a short time period, PAF and INT tend to be negatively correlated (~ -0.27).
There also seems to be a series of readings that are slightly positively correlated.

2. Do age or individual differences explain the distribution?

Correlation histograms of individual data



Summary statistics



The variation in PAF/INT correlation appears to increase with age.

Closing remarks



Limitations

- Epilepsy pathology
- Number of participants
- Depth/breadth of analysis

Next steps

- Analyze other factors that may contribute to the observed correlations
- Investigate this relationship in a larger dataset (more EMU patients, healthy participants with MEG)
- Investigate this relationship in patients with neurodevelopmental disorders
- Replicate with stereo EEG data (subcortical information)

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