# Combining Microdialysis and Electrophysiology in Cerebral Cortex to Delineate Functional Implications of Acetylcholine Gradients

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## Background/Relevance

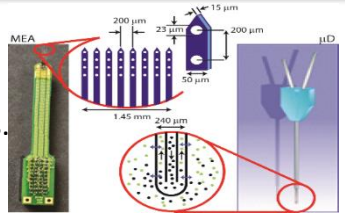
- Neural response changes from trial to trial for repeated sensory stimulus.
- Cholinergic neuromodulation induces cortical state change.
- Hypothesis – cortical state is heterogeneous across the spatial extent of the cortical network and this heterogeneity enables the cortical network to maintain reliable sensory detection.

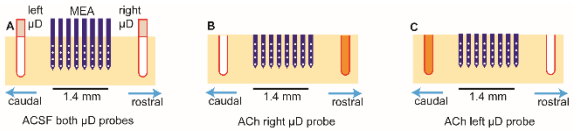
## Innovation

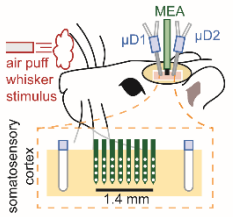
- A novel combination of microelectrode array (MEA) and microdialysis (µD) probes for precision chemical and electrophysiological measurements.

## Approach

- Implant the device in rat brain.
- Control ACh concentration via µD probes.
- Measure the neural activity in terms of action potentials via MEA in response to whisker simulation under varying chemical conditions.




## Key Results

- Data Analysis

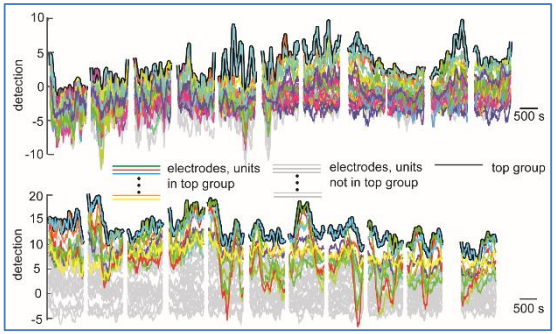



**Figure :** Heterogeneity across population maintains good detection. Changes in detection from 32 different locations with (A) ACh infusion, (B) neostigmine infusion.

## Conclusions

- Cortical state is spatially inhomogeneous across the cortical network.
- Changes in ACh spatial distribution pattern lead to different cortical states at different locations in the cortical network.
- The heterogeneity in cortical state allowed for reliable population-level detection despite unreliable detection at the level of single electrodes.

Reference: Shew Lab
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