Modulation of auditory responses by modality-specific attention in rat primary auditory cortex

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239

Introduction

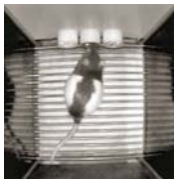
Does attending to a sound modulate the neural representation of that sound in auditory cortex? What's the underlying mechanism?

In order to answer these questions, we established a simple rodent model of modality-specific attention. Here we describe results from experiments in freely moving rats in which we used tetrodes to record neural responses in primary auditory cortex (area A1) while subjects performed this behavior.

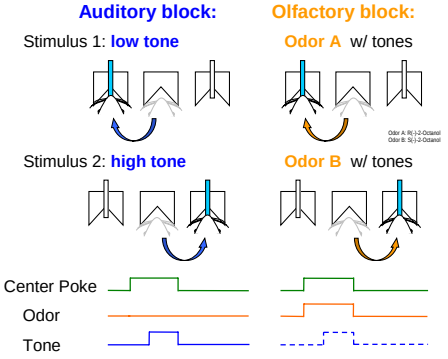
Two alternative choice task

Tone 1: low frequency

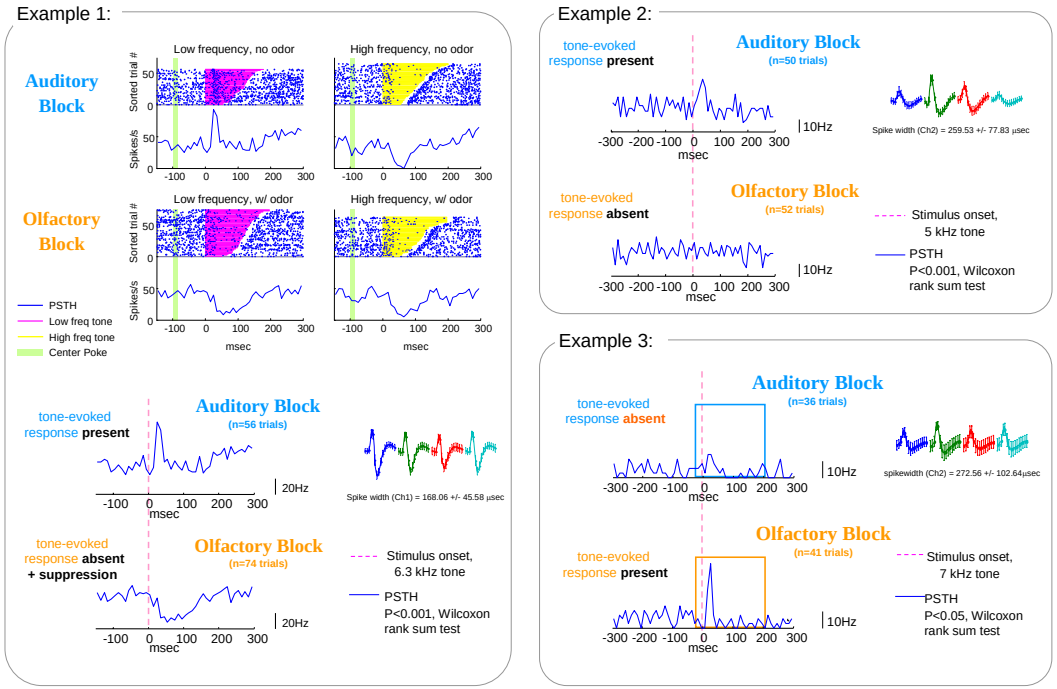
Tone 2: high frequency



Modality-specific attention task



Cross-modal attentional modulation in rat primary auditory cortex



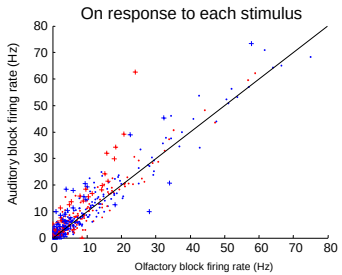
Group statistics

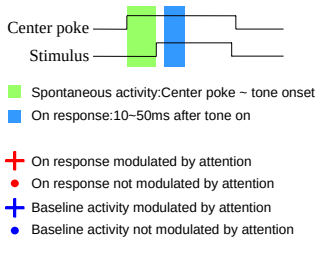
50.3% (156/310) units with statistically significant on response

24.4% (38/156) of ON-responsive units showed modulation of on response

3.2% (5/156) of ON-responsive units showed modulation of firing to the non-responsive stimulus

24.2% (75/310) units showed modulation of spontaneous firing rate





Summary

1. We have established a simple rodent behavior model for studying modality-specific attention.
2. Modality-specific attention can strongly modulate neural responses evoked by exactly the same auditory stimulus in rat primary auditory cortex.

Methods

Long-Evans rats (150g ➔300~400g)

Two alternative choice paradigm:

auditory ➔ blocks of auditory / olfactory ➔ blocks of auditory / olfactory with distracters

Low frequency ~6kHz, High frequency ~14kHz

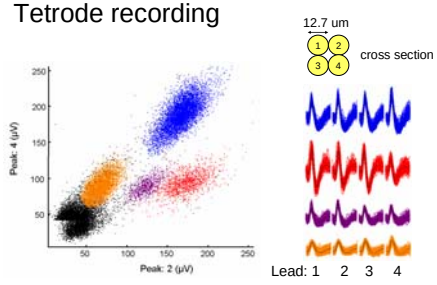
Reward: ~30µl water

Odorant: R(-)-2-Octanol and S(+)-2-Octanol

Training time: ~6 weeks

Criteria: performance >80%

Tetrode recording



http://zadorlab.cshl.edu/tai/Tai_2006_Cosyne_poster.pdf