第163回 創薬科学セミナー・GTRセミナー

Signal-in-noise processing and receptive field development in the rat auditory cortex: explored with noise exposure

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Lecture room (205) in Pharm. Sci. Bldg.

During critical periods, receptive fields (RFs) develop to adapt to the sensory environment by forming neural circuits that optimally process relevant stimuli. In humans, this developmental stage is essential for acquiring language. It has been shown that sound exposure during a critical period dynamically altered the RF properties in the auditory cortex such as frequency tuning, tuning bandwidth, or temporal resolution (de Villers-Sadani and Merzenich, 2011). However, the relationship between this altered neural coding and perceptual abilities is yet largely unknown. In this study, we tested the hypothesis that exposure to moderate levels of structured background noise during the critical period enhances the ability of adult animals to process vocalization in noise. We raised rat pups in moderate noises (~60 dB SPL) of different spectro-temporal statistics during their auditory critical period (P6-45). Once these animals reached adulthood, we trained them to detect vocalizations presented in these noises and compared to unexposed animals. The noise exposure enhanced their behavioral performance of detecting rat vocalizations in background noise. Improvement depended on stimulus statistics used for noise exposure. In addition, cortical signal encoding of vocalizations was improved in noise-exposed animals accompanied by specific shifts in RF properties compared to unexposed animals. Furthermore, we examined if noise exposure during the adulthood can induce comparable effects on the vocalization encoding and RF shifts similar to the critical period noise exposure. Our findings support the idea that noise exposure can improve cortical receptive field properties best suited for information extraction in noisy environment thus reducing the impact of background noise masking and helping the animals to perceptually segregate signals from noise background.

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