

# Stimulus-driven response dynamics of the whisker/barrel-cortex system in awake behaving rats

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Many rodents actively sense the environment using an extensive whisker system on the snout, which has a large somatotopic representation in primary somatosensory cortex. Although many studies have investigated this system in anesthetized rats, there has been a growing recognition of the importance of making electrophysiological recordings in awake behaving animals. We made multiple simultaneous single unit extracellular and multiple field potential recordings from the barrel region of primary somatosensory cortex in adult female Long-Evans rats that were trained to run on a linear track. We placed several piezo-electric films on the side of the track in order to make discrete deflections of the contralateral whiskers with accompanying PSTHs, with varying time separations between each deflection. This paradigm allows us to probe the dynamics of tactile responses in the barrel-cortex network. It has been shown that behavior state modulates tactile responses. We hypothesize that the shallow, short suppression following a stimulus that is characteristic of the awake state optimizes the rat's sensory discrimination ability, while the deep, long suppression characteristic of the quiescent state optimizes the rat's ability to detect the onset of stimuli. Further work will employ a behavioral paradigm that requires the rat to make a choice after a whisker-based detection or discrimination between different piezo spacings, under varying attentional states, in order to test this hypothesis.

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