

POSTER PRESENTATION

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Differential neural responses to naturally occurring envelopes in the electrosensory system

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Natural sensory stimuli frequently consist of a fine structure whose amplitude (i.e. envelope) varies more slowly. Previous studies have demonstrated that envelope signals are found across sensory systems and are necessary for perception. For example, envelope signals in the auditory system carry information pertaining to the perception of pitch fluctuations in communication vocalizations [1], while envelopes in the visual system are responsible for object grouping and the perception of illusory contours [2,3]. However, the neural mechanisms underlying the encoding of these envelope signals are poorly understood in general. Gymnotiform wave-type weakly electric fish constitute an attractive model system for studying envelope processing in the brain because of its well-characterized anatomy and physiology [4]. These fish generate around themselves a weak quasi-sinusoidal electric field through the electric organ discharge (EOD) [5]. Recent studies have shown that the beat amplitude (i.e. the envelope) can vary in time during different behavioral contexts and display differential frequency content: while envelopes caused by movement primarily contain low (<1 Hz) temporal frequencies [6], those caused by social interaction instead contain higher (>1 Hz) temporal frequencies [7]. While it is known that electrosensory neurons can respond to envelopes [7], whether these neurons respond differentially to envelopes arising from movement and social interaction is unknown in part because their tuning to envelope frequencies has not been characterized. Here we used well established techniques [8] to record from electrosensory pyramidal neurons across different maps of the body surface within the electrosensory lateral line lobe (ELL) in response to envelope stimuli with different frequency

content spanning the behaviorally relevant range (0.05–10 Hz). Using standard measures of linear systems identification techniques as well as more quantitative methods of information theory, we found that pyramidal neurons in different maps displayed differential responses to envelopes arising from different behavioral contexts. Our results suggest that information about envelopes arising from different behavioral contexts begins to be segregated at the level of the ELL and provide new insights as to how these behaviorally relevant stimuli are encoded in early sensory pathways.

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