DIFFERENTIAL CODING OF PREY AND COMMUNICATION STIMULI BY SENSORY NEURONS

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ABSTRACT

Animals must distinguish between prey and communication signals in order to survive in their environment. In weakly electric fish, these signals differ in their spatial extent and their frequency content since prey stimuli are spatially localized and low frequency while communication stimuli are spatially diffuse and high frequency. We show that sensory pyramidal neurons in these fish display oscillatory dynamics in response to communication-like stimuli but not prey-like stimuli. Simulations of a leaky Integrate-and-fire network with delayed inhibitory feedback predict these oscillatory dynamics only for communication-like stimuli. This prediction is verified experimentally by reversible blockade of feedback inhibition showing reduced oscillatory dynamics under communication-like stimuli, thus suggesting that this sensory system is able to distinguish between prey and communication stimuli using oscillatory dynamics[1]. Moreover, we show that these same pyramidal neurons are able to switch their frequency tuning to match prey and communication-like stimuli based on their differing spatial extents. Intracellular recordings reveal that prey and communication stimuli activate different constellations of synaptic input, thus allowing the switch in frequency tuning. Further experiments reveal that activation of the non-classical receptive field and spatial saturation of the receptive field center by communication stimuli is sufficient to induce this switch[2].

Keywords: neurobiological switch, delayed feedback, sensory coding.

References

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