BMC Neuroscience

Poster presentation

Open Access

Frequency filtering of vestibular signals by synaptic transmission in brainstem slices

Dianne M Broussard* and Allison L Guy

Address: Toronto Western Research Institute, University Health Network, Toronto, Canada

Email: Dianne M Broussard* - dianne@uhnres.utoronto.ca

* Corresponding author

from Sixteenth Annual Computational Neuroscience Meeting: CNS*2007
Toronto, Canada. 7–12 July 2007

Published: 6 July 2007

BMC Neuroscience 2007, **8**(Suppl 2):P99 doi:10.1186/1471-2202-8-S2-P99

Frequency-modulated (FM) signals are present in neural systems that are characterized by high discharge rates and continuously-varying stimulus parameters, such as the vestibular system. In the medial vestibular nucleus (MVN) a rate code is used to encode the speed of head rotation and the modulating frequency is equal to the rotation frequency. During rotation in the 1–10 Hz range, many neurons in the medial vestibular nucleus (MVN) have frequency-dependent responses. The role of synaptic processes such as summation and short-term plasticity in the frequency dependence of MVN responses has not been established. Vestibular afferents to the MVN are tonically active in the range of 100 spikes/s, modulated in proportion to head velocity. We asked whether this velocity signal is filtered by synaptic transmission in the brainstem. We found short-term depression and summation of the evoked EPSPs in nearly all MVN cells. Responses to FM pulse trains were dominated by summation of EPSPs, so that membrane potential was approximately sinusoidal during continuous FM stimulation. Responses were highly dependent on the modulating frequency. In the presence of GABA antagonists, postsynaptic potential showed a variety of frequency responses. Long-lasting EPSPs were associated with low-pass filtering of the modulating signal. Short EPSPs were associated with high-pass filtering. Short-term depression resulted in distortion of the sinusoidal response. Modeling using depression and recovery duplicated the form of the responses but failed to simulate the frequency response. We conclude that synaptic transmission between primary afferents and MVN neurons may contribute to frequency filtering in the vestibular pathway.