In the inner ear sounds are converted into action potentials and propagated to the central nervous system. The cochlear nucleus in the auditory brainstem is the first station that receives synaptic inputs from auditory nerve fibers (ANF) and consists of several neuron types. Here we focus on globular bushy cells (GBC) that are part of the sound localization pathway. One of the main properties of GBC is their excellent temporal firing precision in response to sounds. Our model of GBCs is a point neuron with Hodgkin-Huxley type ion channels (HPAC, Kht, Kl). It receives several excitatory inputs from an inner ear model simulating responses of ANFs. ANF activity drives endbulb of Held synapses located directly on the GBC soma. We modeled two types of synapses: with short-term depression as measured in many in-vitro studies (Yang and Xu-Friedman 2009) and without depression as reported by recent in-vivo studies (Borst 2010). The model is able to reproduce standard experiments involving pure tone stimulation. In particular the PSTH displays proper levels of spontaneous and driven rates as well as characteristic primary-like with notch shapes. Additionally, stimulation with low frequency tones shows improvement in synchronization that can be characterized as high-sync (SI > 0.9) according to Joris et al. (1994). Interestingly high entrainment levels where achieved only by the model without synaptic depression. In summary, our model is able to reproduce the key features of GBC.
responses. Our results suggest that depression in-vivo is much lower compared to in-vitro conditions. In the future, the model will allow us to study the response of GBCs to complex natural stimuli like speech.

Stichworte: bccn, poster, ss2010

Zeitschriftentitel: Frontiers in Computational Neuroscience

Jahr: 2010

Band: 4

Heft / Issue: 0

Seiten: 5

Volltext / DOI: http://doi.org/10.3389/conf.fncom.2010.51.00015

Occurences: · Einrichtungen > Fakultäten > Fakultät für Elektrotechnik und Informationstechnik > Lehrstühle und Professuren > Bioanaloge Informationsverarbeitung (Prof. Hemmert) > Publikationen > 2010

entries: