

CENTRAL SYNAPSES TRANSFORM TEMPORAL INFORMATION CARRIED BY AN AFFERENT TRAIN. Zhuo Wang^{1,3} and T.W.Berger^{1,2,3}. ¹*Program in Neuroscience,* ²*Department of Biomedical Engineering,* ³*Center for Neural Engineering, University of Southern California, Los Angeles, CA 90089.*

It is well established that the temporal structure of synaptic input is critical in determining the pattern of calcium accumulation in postsynaptic compartments and in turn the induction of long-term synaptic plasticity at many central synapses. Due to the probabilistic nature of these synapses, the temporal pattern of synaptic release at an individual synapse is different from that of the input. Understanding the temporal transformation by probabilistic synapses is important for modeling studies of calcium accumulation during inputs of different frequencies. We used a modified parametric model of short-term plasticity (Dittman et al. 2000) to simulate the stochastic release of a group of synapses of a CA1 pyramidal cell in response to afferent trains. The model incorporated both calcium-dependent facilitation and calcium-dependent recovery from depression. We assumed that synaptic release at each synapse is an all-or-none process and depends only on its own history of release. Results showed that during input trains of 10, 50, 100, and 200 Hz, individual synapses on average release at frequencies of 5.5, 20, 27, and 40 Hz, respectively. The fact that individual synapses release at frequencies significantly lower than the input frequency may have substantial impact on the temporal requirement of the induction of long-term synaptic plasticity. Supported by ONR and NCRR.