Meeting: 1002, Pittsburgh, Pennsylvania, SS 13A, Special Session on Mathematical Biology

1002-92-170 **Eun-Hyoung Park*** (exp43@case.edu), Department of Biomedical Engineering, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106, and **Dominique M. Durand**, Department of Biomedical Engineering, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106. *A Computational Study of the Role of Potassium Diffusion in the Generation and Propagation of Zero Ca2+ Non-Synaptic Sustained Epileptiform Activity.*

An increase of extracellular potassium ion concentration can result in neuronal hyperexcitability, and thus contributes to non-synaptic epileptiform activity. Potassium diffusion alone is sufficient for synchronization in vitro. However, it is not yet known whether potassium diffusion can, by itself, induce seizure activity. We hypothesize that spontaneous sustained neuronal activity can be generated by potassium coupling between neurons. To test this hypothesis, a two-neuron model was used. Each model neuron was embedded in a bath and surrounded by interstitial space. Excessive potassium ions in the interstitial space were regulated by both K-pump and glial buffer mechanism. Simulations performed with two coupled neurons with parameter values within physiological show that, without chemical and electrical synapses, potassium diffusion alone can suffice to generate and synchronize zero Ca+ non-synaptic epileptiform activity. Our preliminary simulations performed with a network of 10 zero-Ca2+ CA1 pyramidal neurons also show that spontaneous sustained activity can propagate by potassium diffusion alone with velocity of 0.47mm/sec. This result suggests that potassium diffusion could play an important role in the propagation and generation of epileptiform activity. (Received September 13, 2004)