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Gamma Rhythm Simulations in Alzheimer's Disease SAMUEL MONTGOMERY, New Mexico Tech, CARLOS PEREZ, GHANIM ULLAH, University of South Florida — The different neural rhythms that occur during the sleep–wake cycle regulate the brain's multiple functions. Memory acquisition occurs during fast gamma rhythms during consciousness, while slow oscillations mediate memory consolidation and erasure during sleep. At the neural network level, these rhythms are generated by the finely timed activity within excitatory and inhibitory neurons. In Alzheimer's Disease (AD) the function of inhibitory neurons is compromised due to an increase in amyloid beta (Aβ) leading to elevated sodium leakage from extracellular space in the hippocampus. Using a Hodgkin-Huxley formalism, heightened sodium leakage current into inhibitory neurons is observed to compromise functionality. Using a simple two neuron system it was observed that as the conductance of the sodium leakage current is increased in inhibitory neurons there is a significant decrease in spiking frequency regarding the membrane potential. This triggers a significant increase in excitatory spiking leading to aberrant network behavior similar to that seen in AD patients. The next step is to extend this model to a larger neuronal system with varying synaptic densities and conductance strengths as well as deterministic and stochastic drives.

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