

Notice and Invitation

Oral Defense of Master's Thesis

The Volgenau School of Engineering, George Mason University

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Difference Between Prototypical and Arkypallidal Neuron and the Effect of Ethanol

Monday, April 24, 2017, 2:00 pm

Room 3202 Engineering Building

All are invited to attend

Committee

Dr. Avrama Blackwell, Thesis Director

Dr. Parag Chitnis

Dr. Siddhartha Sikdar

Abstract

The Globus Pallidus (GP) is a part of the Basal Ganglia. The GP is further divided into internal Globus Pallidus (GPi) and external Globus Pallidus (GPe). The GPe is in a powerful position to influence the processing of motor information. There are compelling evidences that suggest the pathological activity of GPe contributes to the motor symptoms of a variety of movement disorders like Parkinson's disease. Recently it was discovered that GPe is comprised of multiple cell types, with activity based subdivision into prototypical neuron and arkypallidal neuron. These differences are important because the firing rate for the arkypallidal neuron is lower than that of the prototypical neuron. The arkypallidal neuron innervates the striatum which is a negative feedback and the prototypical neuron innervates the sub thalamic nucleus which is an output pathway. Ethanol effects the open probability of the calcium dependent potassium channel (BKCa) and reduces the firing rate of the arkypallidal neuron. We computationally modeled these neurons in Moose to determine the factors causing the difference in the firing rate. The three channels demonstrated to differ between the two neuron types (Hernandez et.al 2015) are not enough to explain the difference in the firing rate of the two neurons but there are other channels which are responsible for the lower firing rate of the arkypallidal neuron. To simulate the

effect of ethanol we increased the BKCa current and results showed that the firing rate reduced when the BKCa current was substantially high. In summary, our simulations argue that there are other factors that affect the firing rate of the GP neuron and provides a foundation for further studies to determine the difference between the prototypical and arypallidal GP neuron and the effect ethanol has on the neuron.