1051-92-140 **Anna Y Kuznetsova*** (anna.kuznetsova@utsa.edu), Dept Biol., UTSA, One UTSA circle, San Antonio, TX 78249, and **Alexey S Kuznetsov** (alexey@math.iupui.edu), Dept Math Sci, IUPUI, 402 N. Blackford St, Indianapolis, IN 46202. *Firing frequency regulation in a computational model of a midbrain dopaminergic neuron.*

Midbrain dopaminergic neurons fire spontaneously at low frequencies and elicit fast bursting in response to unpredicted reward, thus participating in reinforcement learning. Fast oscillations can not be induced by constant depolarization; instead the frequency is limited due to a bifurcation transition to a fixed point. In a conductance-based model, we show that frequency limitation is caused by the weakness of the spike-producing currents. A multicompartmental model was required to match the frequency limitation to experimental data showing robustness in schematic and reconstructed morphologies. The bifurcation transition was altered by the presence of a BK-type potassium current. The phase of the stimulus onset relative to the pacemaking oscillations explains experimental variability in measuring the transient frequency. Oscillatory mechanisms supporting slow and fast firing depends on different ionic currents. We simulated this difference by altering the contribution of different potassium currents. We compared bursts elicited by high-frequency electrical stimulation, glutamate iontophoresis, and dynamic clamp and the role of nonlinear and linear synaptic currents. Nonlinear NMDA synaptic current exclusively enhances intrinsic ionic currents avoiding frequency limitation. (Received August 22, 2009)