Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Biophysically realistic minimal model of dopamine neuron[1]
SORINEL OPRISAN, College of Charleston — We proposed and studied a new biophysically relevant computational model of dopaminergic neurons. Midbrain dopamine neurons are involved in motivation and the control of movement, and have been implicated in various pathologies such as Parkinson's disease, schizophrenia, and drug abuse. The model we developed is a single-compartment Hodgkin-Huxley (HH)-type parallel conductance membrane model. The model captures the essential mechanisms underlying the slow oscillatory potentials and plateau potential oscillations. The main currents involved are: 1) a voltage-dependent fast calcium current, 2) a small conductance potassium current that is modulated by the cytosolic concentration of calcium, and 3) a slow voltage-activated potassium current. We developed multidimensional bifurcation diagrams and extracted the effective domains of sustained oscillations. The model includes a calcium balance due to the fundamental importance of calcium influx as proved by simultaneous electrophysiological and calcium imaging procedure. Although there are significant evidences to suggest a partially electrogenic calcium pump, all previous models considered only elecrtogenic pumps. We investigated the effect of the electrogenic calcium pump on the bifurcation diagram of the model and compared our findings against the experimental results.

[1]This research was supported by a R&D grant from the College of Charleston and NASA EPSCoR grant 1163-7558-231-2006286.

Sorinel Oprisan
College of Charleston

Date submitted: 05 Dec 2007 Electronic form version 1.4