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Mathematical Modeling and Analysis of Dopaminergic Neurons

Midbrain dopaminergic (DA) neurons, the main source of dopamine, are slow intrinsic pacemakers. In response to diverse stimuli or pharmacological manipulations, they exhibit tonic firing, bursting or depolarization block. These activities are associated with human neurological disorders, for example, Parkinson's disease and schizophrenia. We present a mathematical model of DA neurons to uncover the ionic basis of the activities described above. Our model successfully reproduces experimental results. The bifurcation analysis is then applied to study its underlying dynamics.