Monte Carlo Simulations of catecholamine neurotransmitters using cell-attached patch amperometry

Bhatnagar, Akrita; Verone, Alissa

Pittsburgh Supercomputing Center

University of Pittsburgh, Carnegie Mellon University

Catecholamines are charged neurotransmitters found in the chromaffin cells. The release of catecholamine, through a narrow fusion pore, requires a charge compensation by other ions to maintain an osmotic balance. The aim of this research is to show that the exocytotic catecholamine release is not associated with the cation flux through the channels in the vesicle membrane, but the Na^+ influx through the fusion pore.

This is studied by using the technique of cell-attached patch amperometry, which serves a dual purpose: the pore openings are characterized by capacitance measurements, while catecholamine release is recorded simultaneously by an amperometric current.

To represent such models with varying dimensions and for mesh generation a blender is used, which is exported as a Model Description Language (MDL) and run in a MCell3 program to create simulation objects using specialized algorithms. The meshes are visualized, imported and edited in DReaMM.