Computational Poster Number P-51

A Theoretical Study of Membrane-Remodeling By Ras Proteins

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Ras proteins function as conformational switches controlling cell proliferation, differentiation and development. The signaling function of these proteins was found to depend on their ability to form protein-lipid nanodomains on the plasma membrane. Apparently driven by competing forces emanating from their lipid-modified C-terminus and the globular catalytic domain, nanodomains of different Ras proteins are differently arrayed on the plasma membrane. The potential of this phenomenon to lead to a unique mechanism of signal regulation at the membrane level has attracted much interest in recent years. In this project, we plan to study (1) how multiple Ras proteins oligomerize on the membrane surface, (2) how these oligomers may serve as membrane curvature regulators, and (3) how this might be influenced by conformational variations. To address these issues, we will perform multiple coarse-grained molecular dynamics simulations to study the structure and dynamics of active and inactive H-ras proteins in a model membrane.