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Stochastic Modeling of the Clathrin-dependent and -independent Endocytic Pathways[1] HUA DENG, PRASHANTA DUTTA, JIN LIU, Washington State University, Pullman WA — Endocytosis is one of the important processes that bioparticles use to enter the cells. During endocytosis the membrane-bound vesicles are formed by the invagination of plasma membrane as a result of interactions among many proteins and cytoskeletons. The clathrin-mediated endocytosis is one of the most significant form of endocytosis, where the dynamic assembly of clathrin-coated pits play a critical role. While herpes simplex virus-1 has recently shown to infect cell by a novel phagocytosis-like endocytic pathway where actin polymerization may facilitate the viral entry. In this work, we propose a stochastic model for both clathrin-dependent and –independent endocytic pathways based on Monte Carlo simulations. The important roles of clathrin coating and actin cytoskeleton as well as the impact of other biological parameters are studied. Our preliminary results indicate that there exist an intermediate particle size and ligand density that maximize the internalization efficiency. Below a critical size or surface ligand density, it is difficult for the entry of a single particle, which means clustering may needed for more efficient internalization. We also find that lower membrane bending rigidity may help promote the bioparticle entry.

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Jin Liu
Washington State University, Pullman WA

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