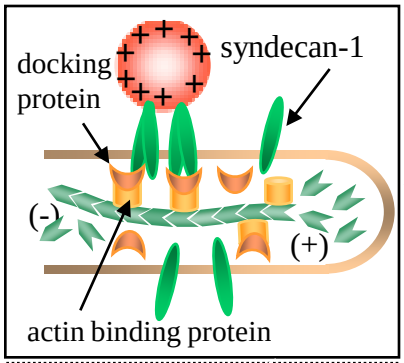
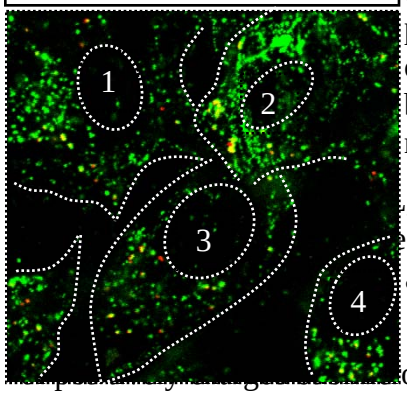
Internalization and Fate of Individual Manufactured Nanomaterial within Living Cells

The cellular interactions and pathways of engineered submicrometer and nanoscale particles dictate the cellular response and ultimately govern the level of toxicity or biocompatibility of the particles. The interactions and pathways must be determined by the specific physicochemical properties of the particles, but the relationships between particle properties and these cellular processes are largely unknown. Here we investigate the initial interactions and subsequent internalization pathways of positively or negatively charged synthetic amorphous silica particles, which are used extensively in a wide range of industrial applications, and are explored for drug delivery and medical imaging and sensing. We find that syndecan-1 (colored in green in the figures on the right) plays a critical role in the initial interactions of positively charged particles (in red) at the cell surface, their coupling with actin filaments across the cell membrane, and their subsequent internalization in alveolar type II epithelial cells, a target cell for inhaled particles. This information adds to our understanding of mechanisms underlying potential toxicity or biocompatibility of airborne submicrometer and nanoscale manufactured particles.





, Tarasevich BJ, Dohnalkova A, Hu D, Teeguarden JG, Pounds JG, e inorganic particles exploit the actin machinery to be propelled along alveolar cells, *ACS Nano* 1, 463, 2007

Phillips JL, Tarasevich BJ, Pounds JG, Syndecan-1 mediates the coupling ometer amorphous silica particles with actin filaments across the alveolar epithelial cell membrane, *Toxicology and Applied Pharmacology,* in press, 2009

Supporting/Contributing Agency: EPA STAR Grant: RD-83333801