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UVM SRC 2012

Intracellular Trafficking of Silica Microparticles

Mesoporous materials, defined as having pore diameters between 2-50 nm, have been thoroughly investigated in many areas of research. Commonly composed of either silicon dioxide or polymers, these materials are highly tunable and may be modified to cater towards a vast number of applications. Recently, the use of these materials in targeted drug therapy has demonstrated an improvement over traditional chemotherapeutic treatments. Traditional therapies lack specificity and therefore the administration of a chemotherapeutic attacks both healthy and malignant cells. By internalizing the therapeutic agent within the porous structure, the drug may be protected from the extracellular environment and thus the risk of degradation is reduced. Furthermore, incorporating a cell-specific antibody facilitates a greater degree of localization to the targeted area.

This project aims to characterize and explore the intracellular trafficking of mesoporous silica particles in a variety of cell lines, including small airway epithelial cells and human mesothelioma cells. While previous research has shown that particles of various sizes and chemical composition are taken up by both cancerous and normal cell lines, little is known about how these different cell lines compartmentalize and shuttle these particles throughout the cell cycle. Additionally, the mechanism by which these cells excrete these particles remains ambiguous. By fixating cellular structures and particles with fluorescent tags, fluorescence microscopy has been used to investigate the intracellular pathways of mesoporous silica particles.