Altering nanoparticle uptake pathway by engineering cell membrane stiffness

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Nanomaterials such as nanoparticles (NPs) and liposomes; are taken up by cells via endocytosis, a process that involves deformation of cell membrane [1]. The deformability of cell membrane is dictated by lipid bilayer phase behavior as this can influence the stiffness/softness of the bilayer [2]. Using liposomes exhibiting different phase behavior, we have discovered that energy dependent endocytic uptake of liposomes is related to the stiffness of the liposome. Since, cell membranes can be modified by liposomes through lipid transfer [3], we theorized that liposomal treatment of cells could alter membrane softness/stiffness and therefore influence endocytosis of NPs. Using breast epithelial tumor cells (MD-MBA-231) as a model system we have shown that engineering of cell membrane phase behavior through liposomal pre-treatment can alter dynamin mediated uptake of polymeric NPs. Since there is evidence that in cancer cells dysregulation of lipid synthesis and metabolism alters mechanical properties of cell membranes[4], liposomal treatment opens a new avenue to improve nanomedicines uptake in cancer cells.

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