



Intercellular Co-delivery of R-Phycoerythrin using Nickel Nanowires

Jared Frey, Andrew Fung and Yong Chen

Franklin W. Olin College of Engineering

and

Department of Mechanical and Aerospace Engineering, UCLA

One of the greatest challenges in the delivery of therapeutics is crossing the cellular membrane. Macromolecules that cannot diffuse through the cellular membrane need to be assisted by specific endocytotic pathways. It has been shown in several cell types that nickel nanowires are internalized across this membrane by an unknown mechanism. The objective of this work was to design a verifiable method to deliver a protein that is not endocytosed using nickel nanowires as a delivery vehicle. Nickel nanowires 200 nm in diameter and of controllable length were synthesized by the well-documented template-assisted approach. The wires were then conjugated to streptavidin, a bacterial protein. A biotin crosslinker containing a disulfide spacer arm was then attached via streptavidin-biotin binding. R-phycoerythrin, a large (240 kDa) fluorescent cyanobacterial protein, was bound to the opposing side of the disulfide spacer arm as the model therapeutic. Disulfide bonds have shown to be stable in the extracellular environment but are reduced by the environment of the cytosolic space. This allows the spacer arm to be cleaved and thus release the R-phycoerythrin once inside the cell. The fluorescent property of the R-phycoerythrin makes possible the verification of successful crosslinking as well as visualization and quantification of the release.