

Study of cellular response to functional nanowires using non-linear optical imaging

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Interfacing nanostructures with biology has shown great promise for imaging and treatment of diseases. However, the translation of nanomedicine to clinical setting has been hampered by the limited fundamental understanding of the interactions between nanomaterials and cells. We aim at establishing this understanding and thus enabling rational design of nanomedicine. In this work, we first performed the non-linear optical imaging study of silicon nanowires (SiNWs). This intensive and stable intrinsic optical signal from nanowires, together with depth resolution offered by non-linear optical imaging, enabled intravital imaging of nanowires for the *first time*. We demonstrated intravital imaging of nanowires circulating in the peripheral blood of a mouse and mapping of nanowires accumulated in organs. Using the intensive and intrinsic nonlinear optical signal of SiNWs, we visualized the interaction between the folate and amine group functionalized SiNWs and cells by monitoring the cellular binding and uptake of SiNWs in real time. We demonstrated that the strong specific ligand-receptor interaction between folate on NWs and folate receptors on CHO- β cell membranes expedited agglomeration of folate modified SiNWs on cells and internalization of nanowires. Such specific targeting was further confirmed through control experiments done with normal CHO cell without folate receptors. Weaker non-specific charge-charge attraction led to longer time required for amino group modified SiNWs to be bound on cell membrane. No effective accumulation was noticed for unmodified SiNW with native oxidized surface layer.

Biography

Chen Yang received her doctoral degree in Chemistry in 2006 under the supervision of Prof. Charles M. Lieber at Harvard. She worked as an associate in McKinsey & Co, a business consulting company, from June 2006 to July 2007. Prof. Yang joined Department of Chemistry and Department of Physics at Purdue University in 2007. Her research has been published in high profile journals, including Science, Physics Review Letter and Nano Letters, and been featured by many public press releases, including Chemical and Engineering News, Harvard Gazette magazine. She has won the NSF Career Award in 2009.

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