Beauty and the Beast of PEGylation in Nanomedicine: Insights into Nano-Bio Interfaces

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Nanomedicine is promising for improving therapeutic efficacy and reducing the adverse effects of conventional treatments. PEG (polyethylene glycol) has been widely employed in nanomedicine for conferring stealth effects through its hydrophilicity and steric repulsion effects. Moreover, one could control the biodistribution of nanoparticles by regulating PEG conformation and density on the particle surface. However, once nanoparticles are exposed to the biological system, biomolecular corona formed around the nanoparticles can result in unexpected outcomes. Therefore, understanding the composition and functionality of biomolecular corona is crucial for nanomedicine development.

In this talk, I will share considerations regarding the translational effort of nanomedicine, mainly focusing on PEGylated mesoporous silica nanoparticles (MSNs). We employed LC-MS/MS, SDS-PAGE, DLS, and Zeta potential measurements to identify the biomolecular corona after the in vitro incubation of 25 nm cationic PEGylated MSNs with human plasma and intravenous injection of nanoparticles into the mice. The biodistribution of MSNs after administration in 4T1 breast tumor-bearing Balb/c mice was investigated by a non-invasive in vivo imaging system (IVIS). Our results revealed that superior tumor-targeting efficiency and the urine excretion of intact MSNs could be achieved. In addition, we demonstrated that the length and density of surfaced PEGylation are the keys to avoiding antibody recognition and PEG immunogenicity.