P021 Peptide-capped gold nanoparticles: towards artificial proteins

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Engineering nanometer-size devices possessing complex functions is a fantastic challenge. Ideally, the components of such devices will combine features of Nature's own nanodevices e.g., specific recognition, energy transduction, cooperativity, and the electronic, magnetic, and optical properties of nanomaterials. Existing nanomaterials lack the degree of internal complexity of proteins. I will present a possible route towards the engineering of nanoparticles with a higher degree of internal complexity based on the formation of self-assembled monolayers of peptides at the surface of nanoparticles. Peptides can be designed to form self-assembled monolayers on gold nanoparticles leading to nanomaterials with some chemical properties analogous to proteins. A variety of molecular recognition properties (biotin, strep-tag, histag, DNA, enzyme cleavage and phosphatase sites) are readily integrated within the peptide monolayer and these nanoparticles can be modified by natural enzymes. Monofunctionalized nanoparticles are obtained using separation methods, which have been optimized for proteins (affinity chromatography). Recent unpublished results include the formation of secondary structures (peptide loops) within these monolayers as well as a bioinspired strategy to measure intermolecular distances at the surface of a nanoparticle.