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HARNESSING MULTIPOLAR INTERACTIONS AT THE NANOSCALE: A NOVEL OPPORTUNITY FOR MOLECULAR PHOTONICS AND BIOIMAGING

Mireille H Blanchard Desce[1]

[1]University of Bordeaux, France

In the last decades inorganic nanoparticles have attracted growing attention in the field of nanophotonics, especially for bioimaging purposes. Among them, luminescent metal-, semiconductor- or oxide-based hard nanoparticles have been the most widely used. Yet, they raise concern with respect to toxicity and/or degradability issues. In that context, purely organic fluorescent nanoparticles hold foremost promises. With that goal in mind, we have developed original bottom-up strategies towards biocompatible ultrabright molecular-based nanoparticles specifically engineered as nanotools for bioimaging. Our strategy is based on the design/synthesis of dedicated multipolar dyes as interacting building blocks of nanoparticles which are readily prepared using expeditious and green protocols involving self-aggregation/nanoprecipitation of the dyes in water. Manipulation of molecular confinement of such engineered dyes provides an effective and innovative way to tune and enhance the luminescence and nonlinear optical responses of the nanoparticles by controlling and taking advantage of interchromophoric electrostatic interactions. This route led to biocompatible, ultra-bright pure nanoparticles that combine unprecedented brightness, remarkable colloidal stability and absence of toxicity, providing superior substitutes to quantum dots. Their luminescence can be tuned in the whole visible down to the NIR region. These nanoparticles can be used as ultra-sensitive contrast agents for *in vivo* two-photon angiography in small animals. Moreover, hyper-bright NIR-emitting nanoparticles (named HiFONs) of controlled size which show unprecedented photostability and excellent biocompatibility can be successfully imaged and tracked at the single particle level in water and used as nanotools in multicolor single particle tracking at video rate experiments to explore cellular compartments. Finally, nanointerfacial field promoted fluorescence amplification has been demonstrated for the first time in core-shell binary nanoparticles made from dedicated complementary dyes. This intriguing phenomenon opens a new avenue in the field of molecular nanophotonics.

Biography

Mireille H Blanchard-Desce after studies at Ecole Normale Supérieure in Paris, has completed her PhD from University Pierre and Marie Curie under the supervision of Jean-Marie Lehn at the College de France and Postdoctoral studies at the Institute of Physical Chemical Biology in Paris. She is currently the Head of the molecular photonics and imaging team at the Institute of Molecular Science in Bordeaux University. She has an excellent track record in her research field as evidenced by over 260 publications in reputed journals with H index: 56, 6 book chapters, 7 patents, over 100 invited lectures at conferences and awards.

mireille.blanchard-desce@u-bordeaux.fr