Bright Fluorescent Polymeric Nanomaterials for Biosensing and Bioimaging

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Dye-loaded fluorescent polymeric nanoparticles (NPs) appear as an attractive alternative to inorganic NPs, such as quantum dots (QDots).[1] Confining large number of dyes with bulky counterions within small polymeric nanoparticles makes the latter particularly bright[2] and enable phenomenon of giant light-harvesting.[3] Functionalization of these NPs with DNA yields FRET-based color switching nanoprobes for nucleic acids with single-molecule sensitivity[4] and compatibility with RGB camera of a smartphone,[5] important for cancer diagnostics. We also found that the energy transfer between two NPs connected by DNA duplexes does not follow canonical Förster law, allowing efficient long-range FRET at distances up to 20 nm, important for construction of ultrasensitive biosensors.[6] When applied to cells, the small size of NPs was found essential for their free diffusion in cytosol[7] and detection of intracellular RNA.[8] At the animal level, the high brightness of NPs enabled single-particle tracking in the mice brain and visualization of crossing the blood-brain barrier.[2a] The developed small dye-loaded polymeric NPs open the route to ultrabright tools for sensing and tracking of biomolecules in biology and medicine.

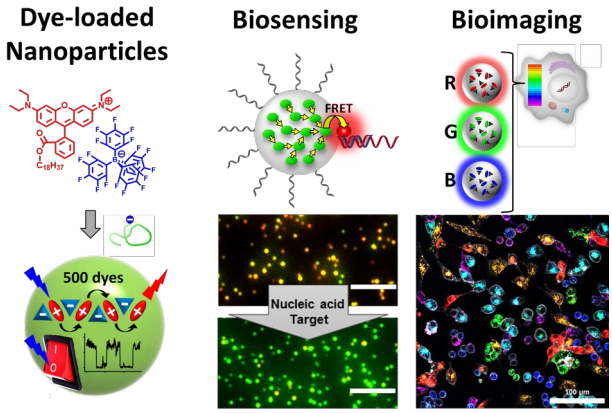

Figure. Dye-loaded polymeric nanoparticles and their biosensing and bioimaging applications.

Keywords: fluorescent polymeric nanoparticles, energy transfer, optical sensing, fluorescence microscopy

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