superparamagnetism

A multifunctional nanobiomaterial has been developed by deliberately combining functions of superparamagnetism, fluorescence, and axonal tracing into one material. Superparamagnetic iron oxide nanoparticles were first synthesized and coated with a silica layer to prevent emission quenching through core-dye interactions; a fluorescent molecule, fluorescein isothiocyanate, was doped inside second layer of silica shell to improve photo-stability and to enable further thiol functionalization. Subsequently, biotinylated dextran amine, a sensitive axonal tracing reagent, was immobilized on the thiol-functionalized nanoparticle surfaces. The resulting nanoparticles were characterized by transmission electron microscopy, dynamic light scattering, X-ray diffraction, X-ray photoelectron spectroscopy, UV-Vis spectroscopy, magnetic resonance imaging and fluorescence confocal microscopy. In vitro cell experiments using both undifferentiated and differentiated Neuro-2a cells showed that the cells were able to take up the nanoparticles intracellularly and that the nanoparticles showed good biocompatibilities. In summary, this new material demonstrated promising performances for both optical and magnetic resonance imaging modalities, suggesting its promising potentials in applications such as in non-invasive imaging, particularly in neuronal tracing [1)].

1)
Du Y, Qin Y, Li Z, Yang X, Zhang J, Westwick H, Tsai E, Cao X. Development of multifunctional nanoparticles towards applications in non-invasive magnetic resonance imaging and axonal tracing. J Biol Inorg Chem. 2017 Dec;22(8):1305-1316. doi: 10.1007/s00775-017-1503-y. Epub 2017 Oct 25. PubMed PMID: 29071442.