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Biosensing applications of upconverting lanthanide nanophosphors

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Rare-earth upconversion nanophosphors (UCNPs) are rapidly emerging as an important class of nanoparticles with potential uses in bioimaging, biosensing and therapeutics. When UCNPs are excited with near infra-red (NIR) light, they exhibit efficient photoluminescence in the visible spectrum due to photon upconversion (UC). Their emission spectrum can be tuned by doping the UCNPs with various lanthanides, allowing for multiple sharp, line-like emission bands, long emissive lifetimes and, as a consequence of their UC, no autofluorescence. These properties make UCNPs particularly promising as biosensing probes. The aim of this project is to develop sensitive and selective UCNP-based biosensing systems. Preliminary work involved investigation of the interaction between the flavin-containing enzyme pentaerythritol tetranitrate reductase (PETNR) and the UCNPs. Promising results have been obtained from this system; UCNPs are able to detect the presence of FMN, the intrinsic cofactor of PETNR, through energy transfer. Using this energy transfer process, enzyme turnover can be indirectly monitored by ratiometric methods due to the multiple bands in the UCNP emission spectra. Work is now focused on improving the sensitivity of this UCNP-enzyme biosensing system.

Biography

Chloë Oakland is a final year PhD student of the North West Nanoscience Doctoral Training Centre (NoWNano DTC) at The University of Manchester, UK. She currently has two publications and was awarded the TA Students Application Award in 2014. She also has industrial experience working in pharmaceutical R&D on the development of inhaled therapeutics to reduce rejection in lung transplant patients and monitoring drug manufacture for the Indian sites of a large generic pharmaceutical company.

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