Strategies based on lanthanide-doped upconversion nano-complex and their biomedical applications

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Lanthanide-doped upconversion nanoparticles possess the remarkable ability to convert multiple near-infrared (NIR) photons into higher-energy ultraviolet-visible (UV-vis) photons, making them a prime candidate for several advanced applications in nanotechnology. Their exceptional properties, including large Stokes' Shift, long lifetimes, tuneable absorption and emission bands, and resistance to concentration quenching, allow widespread applications in therapy, early diagnosis, bioimaging, and drug delivery.[1-3] In addition, unlike UV-vis excitation, NIR excitation is nondestructive at lower power intensities and has high tissue penetration depths (up to 2 mm) with low autofluorescence and scattering. Therefore, these nanocomplexes offer diverse characteristics, including adjustable ratios, morphologies, sizes, and structures. This development marks a significant evolution in lanthanide-based applications, offering novel opportunities and enhanced medical diagnosis and disease therapy capabilities.

In this presentation, I will present our works on lanthanide-doped upconversion nano-complex synthesis, modification, and biomedical applications (Figure 1). Firstly, I will introduce the properties and development principles of the lanthanide complex, including the synthesis strategy, surface modification, and benefits of bioconjugation with biological molecules. Then, I will present our recent progress in applying these luminescent probes for broad biomedical applications in cell imaging, in vivo imaging of zebrafish, disease diagnostics, point-of-care tests, and drug delivery.

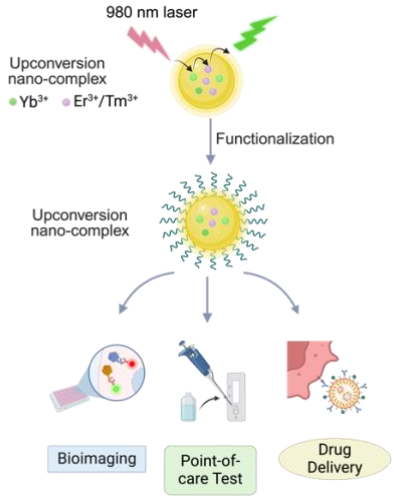

Figure 1: Schematic representation of upconversion nano-complex and their applications.

References:

[1] Fu, L.; et al. *Acta Biomaterialia* **2022**, 147, 403-413.

[2] Fu, L.; et al. *Theranostics: Methods and Protocols* **2019**, 263-282.

[3] Bao, G.; et al. *Coordination Chemistry Reviews* **2021**, 429, 213642