Overcoming autofluorescence: long luminescence lifetime nanoparticles for time-gated bioimaging

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The applicability of fluorescence for in vivo imaging is often hampered by the existence of strong autofluorescence signals especially in the UV and visible parts of the spectrum. In addition, the short penetration of visible light restricts it to in vitro applications. New NIR fluorophores have been developed for the biological windows (BW). The first-BW (650- 950 nm) has been profusely studied although the penetration of light in this region is limited to a few millimeters. The second-BW (1000-1350 nm) is gaining interest because light penetration >1 cm can be obtained.[1] However, the existence of autofluorescence limits the useful wavelengths to the region from 1200-1350 nm, thus reducing the number of available probes for in vivo imaging. [2]

In this work, we present the elimination of autofluorescence signals in in vivo imaging, which takes advantage of the long luminescent lifetimes of trivalent rare earth ions (~100 µs) compared with the lifetime of the biomolecules causing this autofluorescence (<<1 ns). The combination of this with their emissions in the second biological window has allowed us to obtain deep tissue autofluorescence free images by using a simple time-gated set up.

References

[1] A. M. Smith, M. C. Mancini, S. Nie, Nat. Nanotechnol. 2009, 4, 710.
[2] B. del Rosal, I. Villa, D. Jaque, F. Sanz-Rodríguez, J. Biophotonics 2016, 9, 1059.