Luminescent Lanthanide Small Molecules, Polymetallic Dendrimer Complexes, MOF and Metallacrowns for Biological Imaging: from Fundamental Research to Applications

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Fluorescence and luminescence based detection techniques possess important advantages for bioanalytical applications and biologic imaging: high sensitivity, high cellular resolution, portability, versatility and low costs of instrumentation. A common characteristic of biologic analytes present in biological systems is their presence in small quantities among complex matrices such as blood, cells, tissue and organs. These matrices emit a significant background fluorescence (autofluorescence), limiting detection sensitivity.

The luminescence of lanthanide cations has several complementary advantages over the fluorescence of organic fluorophores and semiconductor nanocrystals, such as sharp emission bands for spectral discrimination from background emission, long luminescence lifetimes for temporal discrimination and strong resistance to photobleaching. In addition, several lanthanides emit near-infrared (NIR) photons that can cross deeply tissues for non-invasive investigations and that result in improved detection sensitivity due to the absence of native NIR luminescence from tissues and cells (autofluorescence).

The main requirement to generate lanthanide emission is to sensitize them with an appropriate chromophore ("antenna effect"). The choice of this antenna allows the tuning of the excitation wavelength of the resulting complexes. We will discuss in this paper different strategies and aspects of fundamental and applied research to create imaging agents suitable for optical imaging.

We will discuss different systems that we have created in the last few years including Small Molecules, Polymetallic Dendrimer Complexes, MOF and Metallacrowns

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Figure 1. a) Schematic Representation of a Polymetallic Dendrimer Complex b) Structure of a Near-infrared Emitting Metallacrown c) Structure of a luminescent nanoMOF