Little Something New About Lanthanide Spectroscopy and Imaging

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The conventional energy transfer pathway in organic lanthanide complexes is purported to be from the excited singlet state of the chromophore to the triplet state, and subsequently directly to the emitting state of the trivalent lanthanide ion. In the 1st part of this seminar, we are going to revisit the energy transfer mechanism between organic antenna and lanthanide ion. We show a new understanding on the long phosphorescence with heavy metal effects and designed antennas for lanthanide emitting states that yield high brightness and quantum yields. Four different categories of complexes were inspected using different techniques, such as ultrafast laser transient absorption. The rationale of ligand design of chromophores should be reconsidered, leading to various applications of lanthanide complexes with enhanced quantum yield and brightness. In the 2nd part of this seminar, we are going to share our experience on utilizing the magnetic and luminescent properties of lanthanides for visualizing life science *in vitro*, *in vivo*. We designed a multimodal theranostic agent, so-called an "all-in-one" agent; it is a great example where its building blocks feature both imaging capabilities (MRI and PET) and positive therapeutic effect in a synergistic way.

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