Development and Application of Smart Lanthanide Complexes for Bioimaging

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Imaging technologies are useful for the visualization of biomolecules inside living biological samples and is important for investigating biological phenomena. Various technologies such as CT, MRI, PET and fluorescence imaging are widely used in clinical and research fields. Under the above situation, I have paid attention to lanthanide complexes as new classes of imaging agents because of its unique chemical properties, i. e., magnetic and luminescent properties. For examples, gadolinium (Gd^{3+}) complexes were used as MRI contrast agents, and europium (Eu^{3+}) or terbium (Tb^{3+}) complexes were employed as long-lived luminescent probes. Here, I talk especially about the development of "smart" MRI contrast agents that are capable of probing the molecular profile of tissues by targeting biomolecules, enzymatic activity, etc.

MRI is a noninvasive imaging technology that can provide three-dimensional images inside intact, opaque organisms. On the other hand, most clinically relevant MRI contrast agents are non-targeted compounds that passively distribute into the intravascular and interstitial space. Therefore, smart MRI contrast agents could further open up the possibility of reporting on the physiological state or metabolic activity deep within living specimens. At present, I have successfully developed β-galactosidase-activated and Zn^{2+}-sensitive MRI contrast agents by designing the chelator moiety of Gd^{3+} complexes. Furthermore, I recently focused on the new approach to the development of smart MRI contrast agents, and MRI contrast agents for cell labeling and atherosclerotic plaques were developed by recognition of specific or diseased lesions but not specific biomolecules.

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