Activatable Molecular Probes for Optical Imaging

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For decades, molecular imaging which can monitor inter-/intracellular functions or molecular processes in an organism has provided valuable information for various research fields. Biomarkers such as enzymes, receptors and proteins can be utilized as a target of molecular imaging since they can provide information for early diagnosis and monitoring therapeutic effect of diseases. Among them, receptor-ligand interaction based molecular imaging technique has been emerging promising strategy in theragnosis of intractable diseases such as cancer. However, it is necessary to development of imaging probes, which can provide disease-specific information with high imaging sensitivity. In this point of view, imaging probes which can activate after binding target receptor or ligand might have great advantage in cancer diagnosis due to high selectivity and sensitivity to target molecules. Recently, variety of cell therapeutics such as stem cell and T cell therapy show great potential for treatment of target diseases. Tracking in vivo fate of transplanted cell is critical for cell therapeutics, however few noninvasive techniques are available to track transplanted cells. Therefore, establishing a proper cell labeling and tracking technique is essential for the improvement of cell therapeutic strategies. Labeling variety of cells including stem cells, chondrocytes, and immune cells will provide decisive information of the in vivo fate and bio-distribution which are vital in cell therapeutics.

Here, we developed epidermal growth factor receptor (EGFR) and CD 47 receptor-specific self-quenched imaging probes, which can emit fluorescence (activate) via de-quenching reaction in lysosome, resulting in showing target-specific fluorescence signal in vitro as well as in vivo condition. We also present a simple noninvasive labeling and tracking technique for cell therapeutics via combination of metabolic glycoengineering and biootherogonal copper-free click chemistry, resulting in the cells being tracked via near-infrared fluorescence (NIRF), magnetic resonance (MR) and computed tomography (CT) imaging without cytotoxicity and functional interference.

Key Words: (molecular imaging, activatable probes, optical imaging, drug delivery)

Reference

[1] H Koo, MS Huh, JH Ryu, DE Lee, IC Sun, K Choi, K Kim, IC Kwon, “Nanoprobes for biomedical imaging in living systems”, Nano Today, 6 (2011) 204-220.

[2] DE Lee, H Koo, IC Sun, JH Ryu, K Kim and IC Kwon, “Multifunctional nanoparticles for multimodal imaging and theragnosis”, Chem. Soc. Rev., 41 (2012) 2656-2672

[3] MK Shim, HY Yoon, JH Ryu, H Koo, S Lee, JH Park, JH Kim, S Lee, M. Pomper, IC Kwon, and K Kim, “Cathepsin B-Specific Metabolic Precursor for In Vivo Tumor-Specific Fluorescence Imaging”, Angew. Chem. Int. Ed., 55 (2016) 14698–14703.