

Functional in vivo Imaging of Cellular Dynamics and Enzyme Activity after Inflammation Using Chemical MRI Probes

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Highly sensitive imaging of enzymatic activities in deep region of living organisms have been a difficult challenge for bioimaging materials. Among them, ^{19}F magnetic resonance imaging (MRI) probes are suitable for noninvasively visualizing enzymatic activities in vivo due to zero background signal. Although various enzyme-responsive ^{19}F MRI probes have been developed, most of them have not been applicable to in vivo imaging because of their low sensitivity. Recently, we developed perfluorocarbons-encapsulated nanoparticles and demonstrated that they showed outstanding sensitivity in vivo. Here, we developed enzyme-responsive ^{19}F MRI nanoprobe (FLAME-DEVD 2) for detecting caspase-3/7 activity by employing the paramagnetic relaxation enhancement effect as the OFF/ON switch of ^{19}F MRI signals. After intravenous injection of FLAME-DEVD 2 and apoptosis-inducing reagents, caspase-3/7 activity in a living mouse spleen was successfully imaged by ^{19}F MRI. The results demonstrated that this imaging platform has great potential for highly sensitive detection of enzymatic activities in vivo.