Development of a Fulgimide-Fluorophore Dyad Molecule for Fluorescence Photoswitching in Cellular Imaging

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Photoswitchable fluorescent molecules (PSFMs) whose fluorescence intensities are reversibly changed by light irradiation are biologically important tools for intracellular imaging. Reversibly photoswitchable fluorescent proteins[1] are widely applied as PSFMs to pulse-chase analysis and super-resolution imaging; however, these proteins suffer from photobleaching. Although, in recent years, synthetic PSFMs[2] have been developed to improve photostability, live-cell imaging using these molecules still has been challenging.

Herein, we developed a PSFM, named FF-TMR, containing a photochromic compound, furylfulgimide (FF)[3], and a photostable fluorophore, tetramethylrhodamine (TMR). FF undergoes quantitative photoisomerization between open- and closed-ring forms and is used as a fluorescence quencher based on FRET whose efficiency can be controlled by change in its absorption spectra (Figure 1). As expected, the fluorescence intensity of FF-TMR is changed upon light irradiation. Moreover, the sophisticated molecular design of FF-TMR enables the preparation of the FF-TMR bioconjugates exhibiting reversible and fast fluorescence photoswitching in an aqueous solution. Supporting this result, in fixed cells, the fluorescence intensity of FF-TMR that labeled anti-tubulin antibody was repetitively modulated. In this conference, we will report on the detailed molecular design and photoswitching properties of FF-TMR and its bioconjugates.

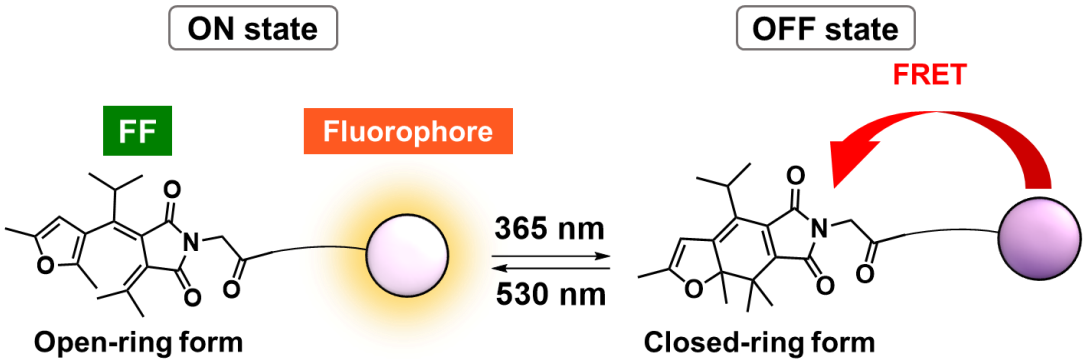

Figure 1. Fluorescence switching strategy of FF-TMR.

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