# Imaging and Control of Biomolecules in Live Cells Using Genetically Encoded Proteins

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Fluorescent and bioluminescent proteins are now widely used for detection of small molecules and various intracellular events in living cells. Such analysis depends on engineered protein-based probes with higher sensitivity and selectivity. The probes can be entirely genetically encoded and can comprise fusions of different proteins or domains. The probes are quite useful for screening new chemical compounds that regulate intracellular signaling.

My laboratory has been developed various kinds of genetically-encoded fluorescent and bioluminescent probes for visualizing many intracellular events in living cells and animals. I herein describe a novel design of engineered luminescent proteins such as GFP and luciferases; the principle is based on reconstitution of the split-protein fragments (reporters) when they are brought sufficiently close together. To demonstrate the usefulness of the split reporters, I will show the reporters for imaging dynamics of endogenous mRNA, protein release from mitochondria and protein-protein interactions in living cells. We further developed another design of reporter proteins; a cyclic luciferase by protein splicing to monitor protease activities in living mice. I will describe possibilities of these probes to screen chemical compounds and highlight some potential applications.

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