

**Luminescent Sensors and Optical Switches for  
Single Cell Analysis**

**Professor Takeaki Ozawa**

University of Tokyo  
Department of Chemistry  
Graduate School of Science



***Abstract***

Engineered fluorescent and bioluminescent proteins are now widely used for analysis of small molecules and various intracellular events in live cells. The luminescent proteins are entirely genetically encoded and can be engineered to generate functional probes. I herein describe a novel design of engineered fluorescent proteins and luciferases for the analysis of intracellular signaling; the principle is based on complementation and reconstitution of the split-reporter fragments when they are brought sufficiently close together. To demonstrate the usefulness of the split reporters, I will focus on different topics: Using fluorescence imaging, I will show methods for imaging dynamics of telomeric RNAs and different apoptotic signals in a single living cells. I will also present novel techniques of bioluminescence imaging of caspase activation and intracellular acidification of living mice in a pathological condition. In addition to the imaging technologies, an optogenetic tool for controlling membrane receptor activity with external light will be discussed. These less-invasive imaging and controlling techniques are widely applicable for understanding complex biological systems with high spatiotemporal resolution.